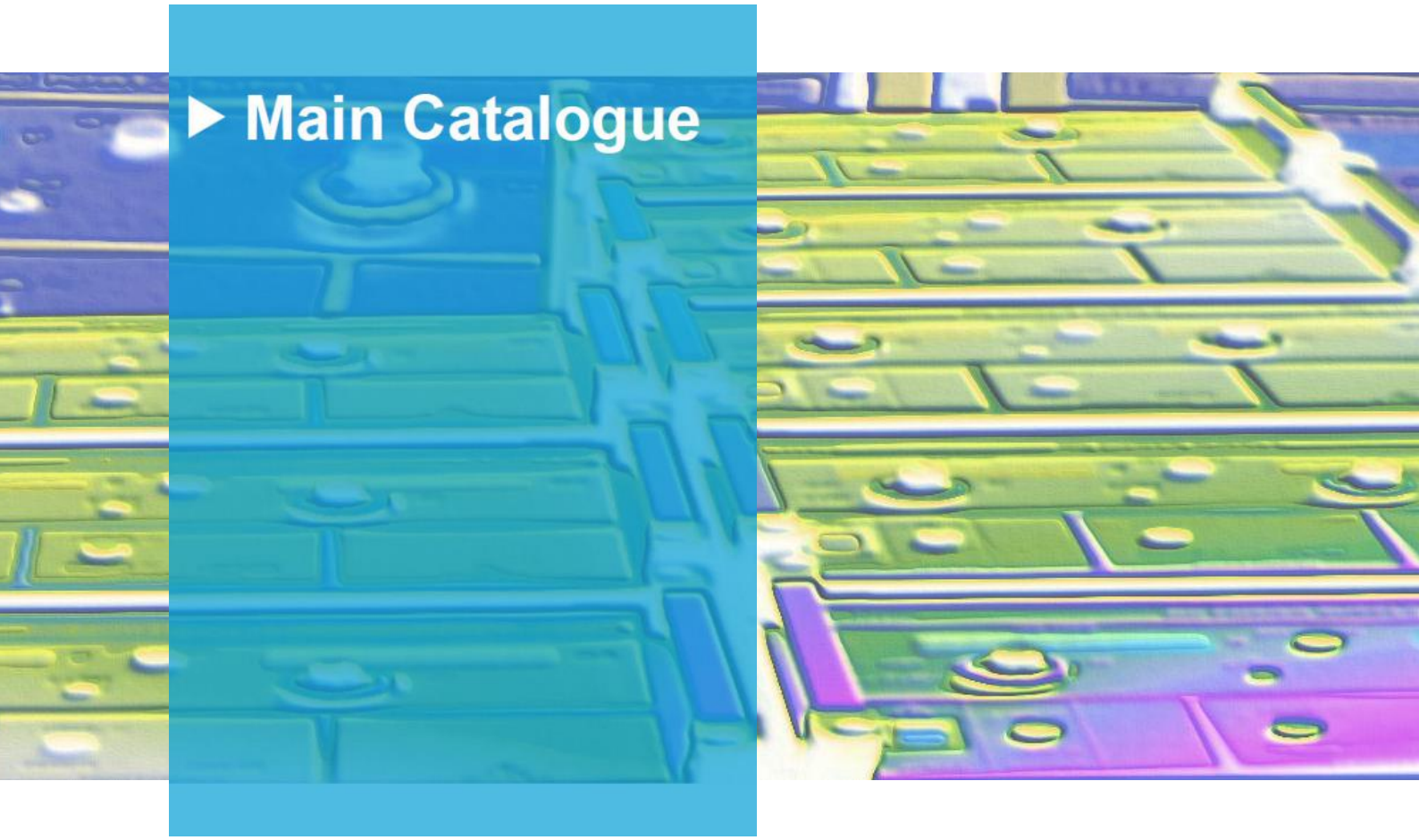
Low and High Voltage Power Supplies



We work according to ISO 9001: 2008

Since 1994 Fug works according to the quality assurance system ISO 9001. All shipped units are checked and documented in our testing department with calibrated measuring devices for compliance to the guaranteed characteristics.

All our products are CE marked.

So we guarantee compliance with all relevant European standards and regulations.

Our power supplies are manufactured and tested in accordance with the following provisions:

EMC:
EN61000-6-1 and EN61000-6-3 (for single-phase mains)
EN61000-6-2 and EN61000-6-4 (for two- and tree-phase mains)

Safety:
EN 61010-1

This catalogue contains over 600 models, more than 100 of them available with short term delivery.

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Product overview

Power supply family	Function	Type range
Low voltage power supplies	linear regulated with thyristor pre-regulation	NTN
	thyristor regulated	NYN
Autoranging power supplies	switched	NCA/ MCA
Medium voltage power supplies	switched	MCP
	thyristor regulated	MYN
High voltage power supplies	switched	HCP
	switched	HCH
	thyristor regulated	HYN
High voltage cassette power supplies	switched	HCE
High voltage capacitor charger	switched	HCK
Power supplies for superconductors	linear regulated with thyristor pre-regulation	NTS
Linear and bipolar power supplies	linear regulated	NLN
	linear regulated bipolar	NLB
	switched bipolar	HCB
Options / interfaces		For the most FuG power supplies
Customer specific power supplies		Typical examples

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Product overview

Upper and lower limits of the maximum output values of each type range								Page
V_{min} Volts	V_{max} Volts	I_{min} Amps	I_{max} Amps	P_{min} Watts	P_{max} Watts	E_{min} J/s	E_{max} J/s	
6,5	350	0,5	4.000	35	100.000			6
12,5	350	60	4.000	7.000	100.000			10
55	3.000	0,75	180	750	9.000			12
125	2.000	0,006	120	14	15.000			14
650	2.000	10	100	7.000	70.000			17
3.500	300.000	0,0003	4,5	14	15.000			19
650	300.000	0,008	75	2.800	50.000			22
3.500	20.000	0.3	20	7.000	70.000			25
125	35.000	0.0002	2,5	7	350			27
2.000	65.000	0.003	20			100	20.000	30
	65		10.000					33
6,5	500	0,06	120	35	1.400			35
± 6.5	± 350	± 0.1	± 120	35	1.400			38
± 1250	± 20.000	± 0.001	± 0.01	1,4	200			41
a variety of options and modifications is available, including a number of interfaces.								44
We manufacture according to customer specification. Please send us the detailed specification of your application.								56

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Low voltage power supplies double stabilized
Series NTN from 6,5 V to 350 V / 35 W to 100 kW

Design Example

NTN 700 - 125
125V / 5A

Features:

- Simple construction
- Short circuit proof and unlimited operation with full current in short circuit condition
- Voltage and current regulation with automatic and sharp transition; control modes indicated by LEDs
- Voltage and current setting via 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 4½ digit DVM for voltage and current (for table-top models)
- Sense terminals for the compensation of voltage drop on the load lines. The nominal voltage always refers to the output terminals
- Parallel and series connection possible
- Suitable also for inductive and capacitive loads
- Safety interlock loop and internal interlock is standard on three-phase units
- Elapsed-hour meter as a standard on three-phase units

Function:

The mains voltage is transformed to the appropriate level. On the secondary side of the transformer is a thyristor controlled rectifier stage (phase cutting circuit), the output of which is used to charge a capacitor bank. This capacitor bank is also connected to the final series regulating transistor output stage. By controlling the conduction angle of the thyristors after each zero-crossing of the sinusoidal voltage, the flow of energy is regulated in such a way as to have a defined voltage drop across the final series transistor stage (pre-regulation). The performance of the final series transistor stage defines the final stability of the output voltage (main regulation).

Design:

- Up to 140W nominal power ½19" table-top case
- For 350W nominal power or higher 19" table-top case
- 19" Rack-adapters for mounting into a 19" rack are available as accessory
- For 7kW nominal power or higher 19" cabinet. Height depending on type. The side covers are detachable and the rear door is lockable.
- All cabinets are equipped with fork-lift-compatible plinths and removable crane-eyes.
- Single cabinets up to 38U are easily transportable by fork-lift.
- Cooling is carried out via convection or built-in fans, with the air being exhausted (depending upon type) either via the rear or the top. For high power units water cooling can also be used.

Output:

- Output isolation:
  The output is floating, maximum operating voltage with respect to earth: ±500V. Either the positive or the negative terminal may be connected to earth. For units equipped with the analog programming: the "0V" of the analog programming is connected to the positive output.
- Output terminals:
  Up to 20A output current, 4mm safety connectors are used on the rear side. For currents up to 300A - clamps are fitted whilst for higher currents we use copper bars.

Technical Data:

- Mains connection:

  Up to 1400W nominal power:
  230V ±10% 47Hz to 53Hz

  For 2800W and higher:
  400V ±10% 47Hz to 53Hz;
  two-phase

  For 7000W and higher:
  400V ±10% 47Hz to 53Hz;
  three-phase
- Ambient temperature: 0°C to +40°C

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 0,1% to 100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$
- Residual ripple (0 - 10MHz):
  $<1 \times 10^{-4}$pp + 10mVpp
- Recovery time:
  Voltage control:
  <50µs for load changes from 10% to 100% or from 100% to 10%.

  Current control:
  <500ms for load changes causing an output change of less than 10% of the rated voltage.

  Units with output voltage >65V, will switch off for a short time at high and fast load changes.
- Setting time at nominal load:
  100ms to 500ms for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load:
  approx. 2sec. to 60sec., depending on type
- Deviation:
  For ±10% mains voltage variation:
  $<\pm 1 \times 10^{-5}$
  For no load / full load:
  $<2 \times 10^{-4}$
  Over 8 hours under constant conditions:
  $<\pm 1 \times 10^{-4}$
  Within the temperature range:
  $<\pm 1 \times 10^{-4}$/K

Possible Options:

- Coarse/fine-potentiometers (99% / 1%) for more accurate adjustment of voltage and / or current
- Analog programming (The positive output has to be earthed; see also page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Roller blades for cabinet units
- Higher stability (see page 48)
- Power limitation (see page 48)

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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Low voltage power supplies double stabilized
Series NTN from 6,5 V to 350 V / 35 W to 100 kW

Type			Voltage		Current		Width	Height	Depth	Weight
NTN	35 - 6,5		0 - 6,5	V	0 - 5	A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NTN	140 - 6,5		0 - 6,5	V	0 - 10	A	½19" / 222 mm	3 U / 133 mm	350 mm	8 kg
NTN	350 - 6,5		0 - 6,5	V	0 - 30	A	19" / 443 mm	3 U / 133 mm	450 mm	18 kg
NTN	700 - 6,5		0 - 6,5	V	0 - 60	A	19" / 443 mm	4 U / 177 mm	450 mm	30 kg
NTN	1400 - 6,5		0 - 6,5	V	0 - 120	A	19" / 443 mm	7 U / 310 mm	550 mm	70 kg
NTN	2800 - 6,5	2)	0 - 6,5	V	0 - 250	A	19" / 443 mm	9 U / 399 mm	650 mm	120 kg
NTN	4200 - 6,5	3)	0 - 6,5	V	0 - 400	A	19" / 600 mm	29 U / 1500 mm	600 mm	300 kg
NTN	7000 - 6,5	3)	0 - 6,5	V	0 - 600	A	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
NTN	10500 - 6,5	3)	0 - 6,5	V	0 - 1000	A	19" / 600 mm	38 U / 2000 mm	800 mm	500 kg
NTN	14000 - 6,5	3)	0 - 6,5	V	0 - 1500	A	19" / 600 mm	38 U / 2000 mm	800 mm	550 kg
NTN	21000 - 6,5	3)	0 - 6,5	V	0 - 2000	A	19" / 600 mm	38 U / 2000 mm	800 mm	650 kg
NTN	28000 - 6,5	3)	0 - 6,5	V	0 - 2500	A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1000 kg
NTN	35000 - 6,5	3)	0 - 6,5	V	0 - 3000	A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1300 kg
NTN	35 - 12,5		0 - 12,5	V	0 - 2,5	A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NTN	140 - 12,5		0 - 12,5	V	0 - 8	A	½19" / 222 mm	3 U / 133 mm	350 mm	8 kg
NTN	350 - 12,5		0 - 12,5	V	0 - 20	A	19" / 443 mm	3 U / 133 mm	350 mm	17 kg
NTN	700 - 12,5		0 - 12,5	V	0 - 50	A	19" / 443 mm	4 U / 177 mm	450 mm	29 kg
NTN	1400 - 12,5		0 - 12,5	V	0 - 80	A	19" / 443 mm	4 U / 177 mm	550 mm	50 kg
NTN	2800 - 12,5	2)	0 - 12,5	V	0 - 150	A	19" / 443 mm	7 U / 310 mm	650 mm	110 kg
NTN	4200 - 12,5	2)	0 - 12,5	V	0 - 250	A	19" / 443 mm	9 U / 399 mm	650 mm	150 kg
NTN	7000 - 12,5	3)	0 - 12,5	V	0 - 500	A	19" / 600 mm	38 U / 2000 mm	800 mm	340 kg
NTN	10500 - 12,5	3)	0 - 12,5	V	0 - 800	A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
NTN	14000 - 12,5	3)	0 - 12,5	V	0 - 1000	A	19" / 600 mm	38 U / 2000 mm	800 mm	520 kg
NTN	21000 - 12,5	3)	0 - 12,5	V	0 - 1500	A	19" / 600 mm	38 U / 2000 mm	800 mm	600 kg
NTN	28000 - 12,5	3)	0 - 12,5	V	0 - 2000	A	19" / 600 mm	38 U / 2000 mm	800 mm	900 kg
NTN	35000 - 12,5	3)	0 - 12,5	V	0 - 2500	A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1300 kg
NTN	50000 - 12,5	3)	0 - 12,5	V	0 - 4000	A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1500 kg
NTN	35 - 20		0 - 20	V	0 - 1,5	A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NTN	140 - 20		0 - 20	V	0 - 6	A	½19" / 222 mm	3 U / 133 mm	350 mm	8 kg
NTN	350 - 20		0 - 20	V	0 - 15	A	19" / 443 mm	3 U / 133 mm	350 mm	17 kg
NTN	700 - 20		0 - 20	V	0 - 30	A	19" / 443 mm	4 U / 177 mm	450 mm	26 kg
NTN	1400 - 20		0 - 20	V	0 - 60	A	19" / 443 mm	4 U / 177 mm	550 mm	50 kg
NTN	2800 - 20	2)	0 - 20	V	0 - 120	A	19" / 443 mm	7 U / 310 mm	550 mm	80 kg
NTN	4200 - 20	2)	0 - 20	V	0 - 200	A	19" / 443 mm	9 U / 399 mm	550 mm	110 kg
NTN	7000 - 20	3)	0 - 20	V	0 - 300	A	19" / 600 mm	29 U / 1500 mm	600 mm	300 kg
NTN	10500 - 20	3)	0 - 20	V	0 - 500	A	19" / 600 mm	38 U / 2000 mm	800 mm	440 kg
NTN	14000 - 20	3)	0 - 20	V	0 - 600	A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
NTN	21000 - 20	3)	0 - 20	V	0 - 800	A	19" / 600 mm	38 U / 2000 mm	800 mm	580 kg
NTN	28000 - 20	3)	0 - 20	V	0 - 1200	A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
NTN	35000 - 20	3)	0 - 20	V	0 - 1500	A	19" / 600 mm	38 U / 2000 mm	800 mm	1200 kg
NTN	50000 - 20	3)	0 - 20	V	0 - 2500	A	2 x 19" /1200 mm	38 U / 2000 mm	800 mm	1400 kg

2) Two phase mains connection
3) Three phase mains connection

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Low voltage power supplies double stabilized
Series NTN from 6,5 V to 350 V / 35 W to 100 kW

Type			Voltage		Current		Width	Height	Depth	Weight
NTN	35 - 35		0 -	35 V	0 -	1 A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NTN	140 - 35		0 -	35 V	0 -	4 A	½19" / 222 mm	3 U / 133 mm	350 mm	8 kg
NTN	350 - 35		0 -	35 V	0 -	10 A	19" / 443 mm	3 U / 133 mm	350 mm	17 kg
NTN	700 - 35		0 -	35 V	0 -	20 A	19" / 443 mm	4 U / 177 mm	450 mm	27 kg
NTN	1400 - 35		0 -	35 V	0 -	40 A	19" / 443 mm	4 U / 177 mm	550 mm	47 kg
NTN	2800 - 35	2)	0 -	35 V	0 -	80 A	19" / 443 mm	7 U / 310 mm	550 mm	70 kg
NTN	4200 - 35	2)	0 -	35 V	0 -	120 A	19" / 443 mm	9 U / 399 mm	550 mm	110 kg
NTN	7000 - 35	3)	0 -	35 V	0 -	200 A	19" / 600 mm	20 U / 1100 mm	600 mm	280 kg
NTN	10500 - 35	3)	0 -	35 V	0 -	300 A	19" / 600 mm	29 U / 1500 mm	600 mm	420 kg
NTN	14000 - 35	3)	0 -	35 V	0 -	400 A	19" / 600 mm	38 U / 2000 mm	800 mm	460 kg
NTN	21000 - 35	3)	0 -	35 V	0 -	600 A	19" / 600 mm	38 U / 2000 mm	800 mm	530 kg
NTN	28000 - 35	3)	0 -	35 V	0 -	800 A	19" / 600 mm	38 U / 2000 mm	800 mm	750 kg
NTN	35000 - 35	3)	0 -	35 V	0 -	1000 A	19" / 600 mm	38 U / 2000 mm	800 mm	950 kg
NTN	70000 - 35	3)	0 -	35 V	0 -	2000 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1500 kg
NTN	35 - 65		0 -	65 V	0 -	500 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NTN	140 - 65		0 -	65 V	0 -	2 A	½19" / 222 mm	3 U / 133 mm	350 mm	8 kg
NTN	350 - 65		0 -	65 V	0 -	5 A	19" / 443 mm	3 U / 133 mm	350 mm	15 kg
NTN	700 - 65		0 -	65 V	0 -	10 A	19" / 443 mm	4 U / 177 mm	350 mm	24 kg
NTN	1400 - 65		0 -	65 V	0 -	20 A	19" / 443 mm	4 U / 177 mm	450 mm	42 kg
NTN	2800 - 65	2)	0 -	65 V	0 -	40 A	19" / 443 mm	5 U / 221 mm	550 mm	55 kg
NTN	4200 - 65	2)	0 -	65 V	0 -	60 A	19" / 443 mm	9 U / 399 mm	550 mm	110 kg
NTN	7000 - 65	3)	0 -	65 V	0 -	100 A	19" / 600 mm	20 U / 1100 mm	600 mm	280 kg
NTN	10500 - 65	3)	0 -	65 V	0 -	150 A	19" / 600 mm	29 U / 1500 mm	600 mm	390 kg
NTN	14000 - 65	3)	0 -	65 V	0 -	200 A	19" / 600 mm	38 U / 2000 mm	800 mm	440 kg
NTN	21000 - 65	3)	0 -	65 V	0 -	300 A	19" / 600 mm	38 U / 2000 mm	800 mm	510 kg
NTN	28000 - 65	3)	0 -	65 V	0 -	400 A	19" / 600 mm	38 U / 2000 mm	800 mm	720 kg
NTN	35000 - 65	3)	0 -	65 V	0 -	500 A	19" / 600 mm	38 U / 2000 mm	800 mm	900 kg
NTN	70000 - 65	3)	0 -	65 V	0 -	1000 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1400 kg
NTN	700 - 125		0 -	125 V	0 -	5 A	19" / 443 mm	4 U / 177 mm	350 mm	24 kg
NTN	1400 - 125		0 -	125 V	0 -	10 A	19" / 443 mm	4 U / 177 mm	450 mm	42 kg
NTN	2800 - 125	2)	0 -	125 V	0 -	20 A	19" / 443 mm	5 U / 221 mm	550 mm	55 kg
NTN	4200 - 125	2)	0 -	125 V	0 -	30 A	19" / 443 mm	9 U / 399 mm	550 mm	110 kg
NTN	7000 - 125	3)	0 -	125 V	0 -	50 A	19" / 600 mm	20 U / 1100 mm	600 mm	250 kg
NTN	10500 - 125	3)	0 -	125 V	0 -	80 A	19" / 600 mm	29 U / 1500 mm	600 mm	300 kg
NTN	14000 - 125	3)	0 -	125 V	0 -	100 A	19" / 600 mm	29 U / 1500 mm	600 mm	400 kg
NTN	21000 - 125	3)	0 -	125 V	0 -	150 A	19" / 600 mm	38 U / 2000 mm	800 mm	490 kg
NTN	28000 - 125	3)	0 -	125 V	0 -	200 A	19" / 600 mm	38 U / 2000 mm	800 mm	680 kg
NTN	35000 - 125	3)	0 -	125 V	0 -	250 A	19" / 600 mm	38 U / 2000 mm	800 mm	850 kg
NTN	50000 - 125	3)	0 -	125 V	0 -	400 A	19" / 600 mm	38 U / 2000 mm	800 mm	1200 kg
NTN	100000 - 125	3)	0 -	125 V	0 -	800 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1700 kg

2) Two phase mains connection
3) Three phase mains connection

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Low voltage power supplies double stabilized
Series NTN from 6,5 V to 350 V / 35 W to 100 kW

Type		Voltage		Current		Width		Height		Depth		Weight	
NTN	700 - 200	0 -	200 V	0 -	3 A	19" /	443 mm	4 U /	177 mm	350	mm	24	kg
NTN	1400 - 200	0 -	200 V	0 -	6 A	19" /	443 mm	4 U /	177 mm	450	mm	42	kg
NTN	2800 - 200 2)	0 -	200 V	0 -	12 A	19" /	443 mm	5 U /	221 mm	550	mm	55	kg
NTN	4200 - 200 2)	0 -	200 V	0 -	20 A	19" /	443 mm	9 U /	399 mm	550	mm	90	kg
NTN	7000 - 200 3)	0 -	200 V	0 -	30 A	19" /	600 mm	20 U /	1100 mm	600	mm	240	kg
NTN	10500 - 200 3)	0 -	200 V	0 -	50 A	19" /	600 mm	29 U /	1500 mm	600	mm	360	kg
NTN	14000 - 200 3)	0 -	200 V	0 -	60 A	19" /	600 mm	29 U /	1500 mm	600	mm	400	kg
NTN	21000 - 200 3)	0 -	200 V	0 -	100 A	19" /	600 mm	38 U /	2000 mm	800	mm	490	kg
NTN	28000 - 200 3)	0 -	200 V	0 -	120 A	19" /	600 mm	38 U /	2000 mm	800	mm	650	kg
NTN	35000 - 200 3)	0 -	200 V	0 -	150 A	19" /	600 mm	38 U /	2000 mm	800	mm	800	kg
NTN	50000 - 200 3)	0 -	200 V	0 -	250 A	19" /	600 mm	38 U /	2000 mm	800	mm	1200	kg
NTN	100000 - 200 3)	0 -	200 V	0 -	500 A	2 x 19" /	1200 mm	38 U /	2000 mm	800	mm	1600	kg
NTN	700 - 350	0 -	350 V	0 -	2 A	19" /	443 mm	4 U /	177 mm	350	mm	24	kg
NTN	1400 - 350	0 -	350 V	0 -	4 A	19" /	443 mm	4 U /	177 mm	450	mm	42	kg
NTN	2800 - 350 2)	0 -	350 V	0 -	8 A	19" /	443 mm	5 U /	221 mm	550	mm	55	kg
NTN	4200 - 350 2)	0 -	350 V	0 -	12 A	19" /	443 mm	9 U /	399 mm	550	mm	90	kg
NTN	7000 - 350 3)	0 -	350 V	0 -	20 A	19" /	600 mm	20 U /	1100 mm	600	mm	240	kg
NTN	10500 - 350 3)	0 -	350 V	0 -	30 A	19" /	600 mm	29 U /	1500 mm	600	mm	275	kg
NTN	14000 - 350 3)	0 -	350 V	0 -	40 A	19" /	600 mm	29 U /	1500 mm	600	mm	400	kg
NTN	21000 - 350 3)	0 -	350 V	0 -	60 A	19" /	600 mm	38 U /	2000 mm	800	mm	490	kg
NTN	28000 - 350 3)	0 -	350 V	0 -	80 A	19" /	600 mm	38 U /	2000 mm	800	mm	650	kg
NTN	35000 - 350 3)	0 -	350 V	0 -	100 A	19" /	600 mm	38 U /	2000 mm	800	mm	800	kg
NTN	70000 - 350 3)	0 -	350 V	0 -	200 A	2 x 19" /	1200 mm	38 U /	2000 mm	800	mm	1350	kg
NTN	100000 - 350 3)	0 -	350 V	0 -	300 A	2 x 19" /	1200 mm	38 U /	2000 mm	800	mm	1600	kg

2) Two phase mains connection
3) Three phase mains connection

Design Example

NTN 4200M - 200
200V / 20A
Customised version
with polarity reversal

NTN 10500 - 200
200V / 50A

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V 0913

Low voltage power supplies thyristor regulated
Series NYN from 12,5 V to 350 V / 7 kW to 100 kW

NYN 70000 - 35
35V / 2000A

Design Example

NYN 42000M - 84
84V / 500A
customer specific design with current consumption unit
(Side covers removed)

Features:

- Simple construction
- Extremely robust
- High efficiency
- Short circuit proof and unlimited operation with full current in short circuit condition
- Voltage and current regulation with automatic and sharp transition; control modes indicated by LEDs
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- Sense terminals for the compensation of voltage drop on the load lines. The nominal voltage always refers to the output terminals
- Limitation of inrush current on switching on
- Suitable also for inductive and capacitive loads
- Interlock loop to monitor the external load and internal loop as a standard
- Elapsed-hour meter as a standard

Function:

The mains voltage is first transformed to the appropriate level. On the secondary side of the transformer is a thyristor controlled rectifier stage (phase cutting circuit). The rectified voltage is smoothed by a LC - filter.

Design:

- Depending on voltage and power the units are built as single or double 19" cabinets of various height. The side covers are detachable, the rear door is lockable.
- All cabinets are equipped with fork-lift-compatible plinths and removable crane-eyes.
- Single 19"- cabinets up to 38U are easily transportable by fork-lift.
- Cooling is carried out via convection or built-in fans, with the air being exhausted (depending upon type) either via the rear or the top.

Output:

- Output isolation:
  The output is floating. The maximum operating voltage with respect to earth: ±500V. Either the positive or the negative terminal may be connected to earth.
- Output terminals:
  All output terminals are located at the rear side of the cabinet. For Output current up to 300A feed though terminals are used; for higher currents the output is via copper bars.

Technical Data:

- Mains connection:
  400V ±10% 47Hz to 53Hz; three-phase
- Ambient temperature:
  0°C to +40°C

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 1% to 100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$
- Residual ripple (0 - 10MHz):
  $<1 \times 10^{-2}$pp + 100mVpp
- Recovery time:
  <100ms to 500ms (depending on type) for load variations of ±10%
- Setting time at nominal load:
  <100ms to 2sec (depending on type) for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load:
  approx. 5sec. to 60sec., depending on type
- Deviation:
  For ±10% mains voltage variation:
  $<\pm 1 \times 10^{-4}$
  For no load / full load:
  $<\pm 1 \times 10^{-3}$
  Over 8 hours under constant conditions:
  $<\pm 3 \times 10^{-4}$
  Within the temperature range:
  $<\pm 3 \times 10^{-4}$/K

Possible Options:

- Analog programming (One of the outputs on “0V” - potential; see also page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Internal resistance setting and regulation (see page 48)
- Power regulation with display (see page 48)
- Roller blades for cabinet units

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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Low voltage power supplies thyristor regulated
Series NYN from 12,5 V to 350 V / 7kW to 100 kW

Type	Voltage	Current	Width	Height	Depth	Weight
NYN 7000 - 12,5	0 - 12,5 V	0 - 500 A	19" / 600 mm	20 U / 1100 mm	600 mm	300 kg
NYN 10500 - 12,5	0 - 12,5 V	0 - 800 A	19" / 600 mm	38 U / 2000 mm	800 mm	440 kg
NYN 14000 - 12,5	0 - 12,5 V	0 - 1000 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
NYN 21000 - 12,5	0 - 12,5 V	0 - 1500 A	19" / 600 mm	38 U / 2000 mm	800 mm	550 kg
NYN 28000 - 12,5	0 - 12,5 V	0 - 2000 A	19" / 600 mm	38 U / 2000 mm	800 mm	820 kg
NYN 35000 - 12,5	0 - 12,5 V	0 - 2500 A	19" / 600 mm	38 U / 2000 mm	800 mm	1200 kg
NYN 50000 - 12,5	0 - 12,5 V	0 - 4000 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1300 kg
NYN 7000 - 20	0 - 20 V	0 - 300 A	19" / 600 mm	20 U / 1100 mm	600 mm	280 kg
NYN 10500 - 20	0 - 20 V	0 - 500 A	19" / 600 mm	38 U / 2000 mm	800 mm	400 kg
NYN 14000 - 20	0 - 20 V	0 - 600 A	19" / 600 mm	38 U / 2000 mm	800 mm	440 kg
NYN 21000 - 20	0 - 20 V	0 - 800 A	19" / 600 mm	38 U / 2000 mm	800 mm	530 kg
NYN 28000 - 20	0 - 20 V	0 - 1200 A	19" / 600 mm	38 U / 2000 mm	800 mm	750 kg
NYN 35000 - 20	0 - 20 V	0 - 1500 A	19" / 600 mm	38 U / 2000 mm	800 mm	1100 kg
NYN 50000 - 20	0 - 20 V	0 - 2500 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1250 kg
NYN 7000 - 35	0 - 35 V	0 - 200 A	19" / 600 mm	20 U / 1100 mm	600 mm	260 kg
NYN 10500 - 35	0 - 35 V	0 - 300 A	19" / 600 mm	29 U / 1500 mm	600 mm	380 kg
NYN 14000 - 35	0 - 35 V	0 - 400 A	19" / 600 mm	38 U / 2000 mm	800 mm	420 kg
NYN 21000 - 35	0 - 35 V	0 - 600 A	19" / 600 mm	38 U / 2000 mm	800 mm	500 kg
NYN 28000 - 35	0 - 35 V	0 - 800 A	19" / 600 mm	38 U / 2000 mm	800 mm	700 kg
NYN 35000 - 35	0 - 35 V	0 - 1000 A	19" / 600 mm	38 U / 2000 mm	800 mm	900 kg
NYN 70000 - 35	0 - 35 V	0 - 2000 A	19" / 600 mm	38 U / 2000 mm	800 mm	1070 kg
NYN 7000 - 65	0 - 65 V	0 - 100 A	19" / 600 mm	20 U / 1100 mm	600 mm	260 kg
NYN 10500 - 65	0 - 65 V	0 - 150 A	19" / 600 mm	29 U / 1500 mm	600 mm	360 kg
NYN 14000 - 65	0 - 65 V	0 - 200 A	19" / 600 mm	29 U / 1500 mm	600 mm	400 kg
NYN 21000 - 65	0 - 65 V	0 - 300 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
NYN 28000 - 65	0 - 65 V	0 - 400 A	19" / 600 mm	38 U / 2000 mm	800 mm	680 kg
NYN 35000 - 65	0 - 65 V	0 - 500 A	19" / 600 mm	38 U / 2000 mm	800 mm	850 kg
NYN 70000 - 65	0 - 65 V	0 - 1000 A	19" / 600 mm	38 U / 2000 mm	800 mm	1070 kg
NYN 21000 - 125	0 - 125 V	0 - 150 A	19" / 600 mm	38 U / 2000 mm	800 mm	450 kg
NYN 28000 - 125	0 - 125 V	0 - 200 A	19" / 600 mm	38 U / 2000 mm	800 mm	650 kg
NYN 35000 - 125	0 - 125 V	0 - 250 A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
NYN 50000 - 125	0 - 125 V	0 - 400 A	19" / 600 mm	38 U / 2000 mm	800 mm	1100 kg
NYN 100000 - 125	0 - 125 V	0 - 800 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1600 kg
NYN 21000 - 200	0 - 200 V	0 - 100 A	19" / 600 mm	38 U / 2000 mm	800 mm	450 kg
NYN 28000 - 200	0 - 200 V	0 - 120 A	19" / 600 mm	38 U / 2000 mm	800 mm	630 kg
NYN 35000 - 200	0 - 200 V	0 - 150 A	19" / 600 mm	38 U / 2000 mm	800 mm	750 kg
NYN 50000 - 200	0 - 200 V	0 - 250 A	19" / 600 mm	38 U / 2000 mm	800 mm	1100 kg
NYN 100000 - 200	0 - 200 V	0 - 500 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1500 kg
NYN 21000 - 350	0 - 350 V	0 - 60 A	19" / 600 mm	38 U / 2000 mm	800 mm	450 kg
NYN 28000 - 350	0 - 350 V	0 - 80 A	19" / 600 mm	38 U / 2000 mm	800 mm	630 kg
NYN 35000 - 350	0 - 350 V	0 - 100 A	19" / 600 mm	38 U / 2000 mm	800 mm	750 kg
NYN 70000 - 350	0 - 350 V	0 - 200 A	19" / 600 mm	38 U / 2000 mm	800 mm	1200 kg
NYN 100000 - 350	0 - 350 V	0 - 300 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1500 kg

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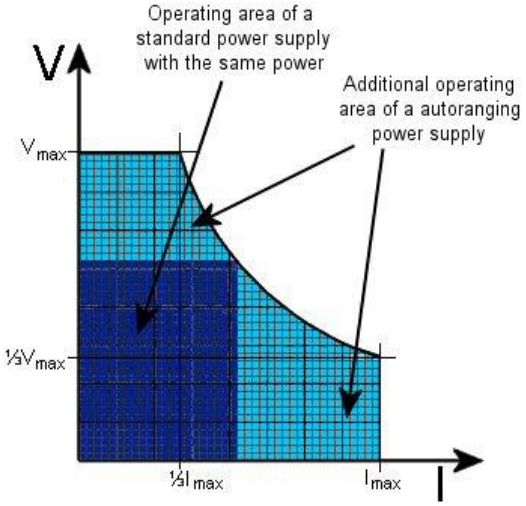
V 0913

Autoranging power supplies
Series NCA / MCA from 55 V to 3000 V / 750 W to 9000 W

Design Example

MCA 9000 - 1500
1500V / 18A, max. 9000W



Features:

- Auto ranging characteristic with constant power limitation
- 5 power classes and 6 Voltage classes: 55V to 3000V
- Up to 1500V with floating output
- Compact size (19" case) , Light-weight and High efficiency
- Short-circuit & flashover proof
- Unlimited operation with nominal power (even in short-circuit conditions)
- Voltage and current regulation with automatic, sharp transition and additional power limitation
- Control mode indicated by LED
- 4½ digit DVM for voltage and current for all power classes
- Voltage and current setting with10-turn potentiometers with precision scale; the adjusting knob can be locked
- Indication of set point values by means of button for switch-over of the displays
- Set point adjustment possible with locked output, release of output voltage by means of an "ON" / "OFF" switch
- Suitable also for capacitive loads
- Sense connections to compensate voltage drop at the load cables for NCA
- Active down control for NCA

Function:

The NCA/MCA series is an auto ranging power supply design in which the power supplies operate over the full range of their output voltage & current - up to the units maximum rated output power. This results in an operating range which is up to 3-times wider than that of a more conventional power supply. When fitted with the optional computer interface, the MCA/NCA series become versatile programmable power supplies. In principle, the rectified line voltage drives a square wave generator, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For regulation, the square wave voltage is pulse width modulated.

Design:
19" table-top case (19" rack adapters available)

Output:

- Output isolation:
  Up to 1500V nominal voltage and 3000W power, the output is floating. Either the positive or the negative pole may be connected to earth.
  (Not valid with the option analog programming. If the floating function should remain, the floating analog programming must be chosen).

  Maximum isolation voltage:
  Up to 400V nominal voltage: ±500V.
  At 750V nominal voltage: ±1000V.
  At 1500V nominal voltage: ±2000V.
  At 3000V nominal voltage and for 1500V in the power classes 6000W and 9000W one pole is earthed, the polarity must be indicated when ordering.
- Output terminals:
  Units up to 750V nominal voltage have 4mm safety connectors. For units with output current >10A have output clamps. For units with nominal voltage greater than 1500V and rated current up to 10A SHV connectors are provided, suitable HV-cable connectors are included.
  .

Technical Data:

- Mains connection:

  Up to 1500W nominal power:
  230V ±10% 47Hz to 63Hz;

  For nominal power 3000W and higher:
  400V ±10% 47Hz to 63Hz;
  three-phase
- Ambient temperature:

  0°C to +40°C

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 0,1% to 100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$
- Residual ripple (0 - 10MHz):
  $<2 \times 10^{-4}$pp + 200mVpp
- Recovery time:
  Voltage control:
  <1ms for load changes from 10% to 100% or from 100% to 10%.

  Current control:
  <10ms for load changes causing an output change of less than 10% of the rated voltage
- Setting time at nominal load:
  <300ms for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load:
  approx. 10sec for MCA
  NCA have active down regulation.
- Deviation:
  For ±10% mains voltage variation:
  $\pm 1 \times 10^{-5}$
  For no load / full load:
  $<5 \times 10^{-4}$
  Over 8 hours under constant conditions:
  $<\pm 2 \times 10^{-4}$
  Within the temperature range:
  $<\pm 1 \times 10^{-4}$/K

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V 0913

Autoranging power supplies
Series NCA / MCA from 55 V to 3000 V / 750 W to 9000 W

Type			Voltage	Current	Width	Height	Depth	Weight
NCA	750 - 55		750 W	0 - 55 V	0 - 40 A	19" / 443 mm	3 U / 133 mm	350 mm	12 kg
NCA	1500 - 55		1500 W	0 - 55 V	0 - 80 A	19" / 443 mm	3 U / 133 mm	550 mm	20 kg
NCA	3000 - 55	3)	3000 W	0 - 55 V	0 - 160 A	19" / 443 mm	3 U / 133 mm	650 mm	25 kg
MCA	750 - 150	●	750 W	0 - 150 V	0 - 15 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
MCA	1500 - 150		1500 W	0 - 150 V	0 - 30 A	19" / 443 mm	4 U / 177 mm	450 mm	17 kg
MCA	3000 - 150	3)	3000 W	0 - 150 V	0 - 60 A	19" / 443 mm	4 U / 177 mm	650 mm	37 kg
MCA	6000 - 150	3)	6000 W	0 - 150 V	0 - 120 A	19" / 443 mm	8 U / 355 mm	650 mm	61 kg
MCA	9000 - 150	3)	9000 W	0 - 150 V	0 - 180 A	19" / 443 mm	12 U / 535 mm	650 mm	90 kg
MCA	750 - 400	●	750 W	0 - 400 V	0 - 6 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
MCA	1500 - 400		1500 W	0 - 400 V	0 - 12 A	19" / 443 mm	4 U / 177 mm	450 mm	17 kg
MCA	3000 - 400	3)	3000 W	0 - 400 V	0 - 24 A	19" / 443 mm	4 U / 177 mm	650 mm	35 kg
MCA	6000 - 400	3)	6000 W	0 - 400 V	0 - 48 A	19" / 443 mm	8 U / 355 mm	650 mm	61 kg
MCA	9000 - 400	3)	9000 W	0 - 400 V	0 - 72 A	19" / 443 mm	12 U / 535 mm	650 mm	90 kg
MCA	750 - 750	●	750 W	0 - 750 V	0 - 3 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
MCA	1500 - 750		1500 W	0 - 750 V	0 - 6 A	19" / 443 mm	4 U / 177 mm	450 mm	16 kg
MCA	3000 - 750	3)	3000 W	0 - 750 V	0 - 12 A	19" / 443 mm	4 U / 177 mm	650 mm	33 kg
MCA	6000 - 750	3)	6000 W	0 - 750 V	0 - 24 A	19" / 443 mm	8 U / 355 mm	650 mm	61 kg
MCA	9000 - 750	3)	9000 W	0 - 750 V	0 - 36 A	19" / 443 mm	12 U / 535 mm	650 mm	90 kg
MCA	750 - 1500	●	750 W	0 - 1500 V	0 - 1,5 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
MCA	1500 - 1500		1500 W	0 - 1500 V	0 - 3 A	19" / 443 mm	4 U / 177 mm	450 mm	17 kg
MCA	3000 - 1500	3)	3000 W	0 - 1500 V	0 - 6 A	19" / 443 mm	4 U / 177 mm	650 mm	32 kg
MCA	6000 - 1500	3)	6000 W*	0 - 1500 V	0 - 12 A	19" / 443 mm	8 U / 355 mm	650 mm	61 kg
MCA	9000 - 1500	3)	9000 W*	0 - 1500 V	0 - 18 A	19" / 443 mm	12 U / 535 mm	650 mm	90 kg
MCA	750 - 3000	●	750 W*	0 - 3000 V	0 - 750 mA	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
MCA	1500 - 3000		1500 W*	0 - 3000 V	0 - 1,5 A	19" / 443 mm	4 U / 177 mm	450 mm	17 kg
MCA	3000 - 3000	3)	3000 W*	0 - 3000 V	0 - 3 A	19" / 443 mm	4 U / 177 mm	650 mm	32 kg
MCA	6000 - 3000	3)	6000 W*	0 - 3000 V	0 - 6 A	19" / 443 mm	8 U / 355 mm	650 mm	61 kg
MCA	9000 - 3000	3)	9000 W*	0 - 3000 V	0 - 9 A	19" / 443 mm	12 U / 535 mm	650 mm	90 kg

3) Three phase mains connection
● short term delivery (components on stock)
*Fields marked with * power supply types do not have a floating output.
For orders of power supplies with 3000V nominal voltage please state the required output polarity.

For 1500V and higher, the mating high voltage connectors are included in the scope of delivery. Mating high voltage cables you'll find beginning with page 51.

Possible Options:

- Analog programming (One of the outputs on "0V" - potential; see also page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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V 0913

Medium voltage power supplies
Series MCP from 125 V to 2000 V / 14 W to 15000 W

Design example

Floating output
(rear side)

MCP 15000 - 2000
2000V / 7A

MCP 140 - 1250
1250V / 100mA

Features:

- Compact size and light weight
- Efficiency approx. 90%
- Short-circuit & flashover proof
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with rated power
- Voltage and current regulation with automatic sharp transition, control modes indicated by LEDs
- Adjustable overvoltage protection (limitation of set value)
- 4½ digit DVM's for voltage and current for all models
- Voltage and current setting by means of 10-turn potentiometers with precision scale; the adjusting knob can be locked
- Indication of set point values by means of button for switch-over of the displays
- Set point adjustment possible with locked output, release of output voltage by means of an "ON" / "OFF" switch
- Suitable for inductive and capacitive loads
- Suitable for photomultipliers

Function:

In principle, the rectified line voltage drives a square wave generator of fixed frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For regulation, the square wave voltage is pulse width modulated.
A low residual ripple of the output voltage, together with a high stability, high regulation speed and a low stored energy are all achieved by virtue of the high switching frequency.

Design:

- ½19" or 19" table-top case (depending on output voltage and power).
- 19" Rack-adapters for mounting into a 19" rack are available as accessory.

Output:

- Output isolation:
  The output is floating. Either the positive or the negative terminal may be connected to earth. Units with nominal voltage up to 350V are isolated for ±500V. Units with nominal voltage from 650V up to 2000V are isolated for ±2000V. (Not valid with the option analog programming. If the floating function should remain, the floating analog programming must be chosen).
- Output terminals:
  All output terminals are located at the rear side of the unit. Units up to 350V nominal voltage are equipped with 4mm safety connectors. For nominal voltage of 650V and higher, high voltage connectors with the appropriate dielectric strength are delivered with the power supply.

Technical Data:

- Mains connection:

  Up to 1400W nominal power:
  230V ±10% 47Hz to 63Hz

  For 2800W and higher:
  400V ±10% 47Hz to 63Hz, three-phase
- Ambient temperature:
  0°C to +40°C

(continued on next page)

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Medium voltage power supplies
Series MCP from 125 V to 2000 V / 14 W to 15000 W

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 0,1% to 100%
- Setting resolution:
  ±1 x 10^{-4}
- Residual ripple (0-10MHz):

  Up to 350W nominal power:
  <5 x 10^{-5}pp + 50mVpp

  For 700W and higher:
  <2 x 10^{-4}pp + 200mVpp
- Recovery time:

  Voltage control:
  <1ms for load changes from 10% to 100% or from 100% to 10%

  Current control:
  <10ms for load changes causing an output change of less than 10% of the rated voltage
- Setting time at nominal load:
  <300ms for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load: approx. 2sec. to 10sec., depending on type
- Deviation:
  For ±10% mains voltage variation:
  <± 1 x 10^{-5}

  For no load / full load:
  <1 x 10^{-4}

  Over 8 hours under constant conditions:
  <±1 x 10^{-4}

  Within the temperature range:
  <±1 x 10^{-4} /K

Possible Options:

- Coarse/fine-potentiometers (99% / 1%) for more accurate adjustment of voltage and / or current
- Analog programming (One of the outputs on "0V" - potential; see also page 44)
- Analog programming, floating (see page 44)
- DVM with better resolution
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Lower ripple (see page 48)
- Higher stability (see page 48)
- Lower stored energy (see page 48)
- Power limitation (see page 48)

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

Type			Voltage		Current		Width	Height	Depth	Weight
MCP	35 - 125	●	0 - 125	V	0 - 250	mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	140 - 125	●	0 - 125	V	0 - 1	A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
MCP	350 - 125	●	0 - 125	V	0 - 2,5	A	½19" / 222 mm	3 U / 133 mm	350 mm	6 kg
MCP	700 - 125	●	0 - 125	V	0 - 5	A	19" / 443 mm	3 U / 133 mm	350 mm	9 kg
MCP	1400 - 125	●	0 - 125	V	0 - 10	A	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
MCP	2800 - 125	3)	0 - 125	V	0 - 20	A	19" / 443 mm	3 U / 133 mm	550 mm	23 kg
MCP	5000 - 125	3)	0 - 125	V	0 - 40	A	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
MCP	10000 - 125	3)	0 - 125	V	0 - 80	A	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
MCP	15000 - 125	3)	0 - 125	V	0 - 120	A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg
MCP	35 - 200	●	0 - 200	V	0 - 150	mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	140 - 200	●	0 - 200	V	0 - 600	mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
MCP	350 - 200	●	0 - 200	V	0 - 1,5	A	½19" / 222 mm	3 U / 133 mm	350 mm	6 kg
MCP	700 - 200	●	0 - 200	V	0 - 3	A	19" / 443 mm	3 U / 133 mm	350 mm	9 kg
MCP	1400 - 200	●	0 - 200	V	0 - 6	A	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
MCP	2800 - 200	3)	0 - 200	V	0 - 12	A	19" / 443 mm	3 U / 133 mm	550 mm	23 kg
MCP	5000 - 200	3)	0 - 200	V	0 - 25	A	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
MCP	10000 - 200	3)	0 - 200	V	0 - 50	A	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
MCP	15000 - 200	3)	0 - 200	V	0 - 75	A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg
MCP	35 - 350	●	0 - 350	V	0 - 100	mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	140 - 350	●	0 - 350	V	0 - 400	mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
MCP	350 - 350	●	0 - 350	V	0 - 1	A	½19" / 222 mm	3 U / 133 mm	350 mm	6 kg
MCP	700 - 350	●	0 - 350	V	0 - 2	A	19" / 443 mm	3 U / 133 mm	350 mm	9 kg
MCP	1400 - 350	●	0 - 350	V	0 - 4	A	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
MCP	2800 - 350	3)	0 - 350	V	0 - 8	A	19" / 443 mm	3 U / 133 mm	550 mm	23 kg
MCP	5000 - 350	3)	0 - 350	V	0 - 14	A	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
MCP	10000 - 350	3)	0 - 350	V	0 - 28	A	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
MCP	15000 - 350	3)	0 - 350	V	0 - 42	A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg

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V 0913

Medium voltage power supplies
Series MCP from 125 V to 2000 V / 14 W to 15000 W

Type			Voltage		Current	Width	Height	Depth	Weight
MCP	14 - 650		0 - 650 V	0 -	20 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	35 - 650		0 - 650 V	0 -	50 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	140 - 650		0 - 650 V	0 -	200 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
MCP	350 - 650		0 - 650 V	0 -	500 mA	½19" / 222 mm	3 U / 133 mm	350 mm	6 kg
MCP	700 - 650		0 - 650 V	0 -	1 A	19" / 443 mm	3 U / 133 mm	350 mm	9 kg
MCP	1400 - 650		0 - 650 V	0 -	2 A	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
MCP	2800 - 650	3)	0 - 650 V	0 -	4 A	19" / 443 mm	3 U / 133 mm	550 mm	23 kg
MCP	5000 - 650	3)	0 - 650 V	0 -	7 A	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
MCP	10000 - 650	3)	0 - 650 V	0 -	15 A	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
MCP	15000 - 650	3)	0 - 650 V	0 -	22,5 A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg
MCP	14 - 1250		0 - 1250 V	0 -	10 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	35 - 1250		0 - 1250 V	0 -	25 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	140 - 1250		0 - 1250 V	0 -	100 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
MCP	350 - 1250		0 - 1250 V	0 -	250 mA	½19" / 222 mm	3 U / 133 mm	350 mm	6 kg
MCP	700 - 1250		0 - 1250 V	0 -	500 mA	19" / 443 mm	3 U / 133 mm	350 mm	9 kg
MCP	1400 - 1250		0 - 1250 V	0 -	1 A	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
MCP	2800 - 1250	3)	0 - 1250 V	0 -	2 A	19" / 443 mm	3 U / 133 mm	550 mm	23 kg
MCP	5000 - 1250	3)	0 - 1250 V	0 -	4 A	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
MCP	10000 - 1250	3)	0 - 1250 V	0 -	8 A	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
MCP	15000 - 1250	3)	0 - 1250 V	0 -	12 A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg
MCP	14 - 2000		0 - 2000 V	0 -	6 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	35 - 2000		0 - 2000 V	0 -	15 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
MCP	140 - 2000		0 - 2000 V	0 -	60 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
MCP	350 - 2000		0 - 2000 V	0 -	150 mA	½19" / 222 mm	3 U / 133 mm	350 mm	6 kg
MCP	700 - 2000		0 - 2000 V	0 -	300 mA	19" / 443 mm	3 U / 133 mm	350 mm	9 kg
MCP	1400 - 2000		0 - 2000 V	0 -	600 mA	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
MCP	2800 - 2000	3)	0 - 2000 V	0 -	1,2 A	19" / 443 mm	3 U / 133 mm	550 mm	23 kg
MCP	5000 - 2000	3)	0 - 2000 V	0 -	2,5 A	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
MCP	10000 - 2000	3)	0 - 2000 V	0 -	5 A	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
MCP	15000 - 2000	3)	0 - 2000 V	0 -	7 A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg

3) Three phase mains connection
● short term delivery (components on stock)

For 650V and higher units, the mating high voltage connectors are included in the scope of delivery. Mating high voltage cables you'll find beginning with page 51.

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Medium voltage power supplies thyristor regulated Series MYN from 650 V to 2000 V / 7kW to 70 kW

Design examples

MYN 14000 - 650
650V / 20A

MYN 105000 - 1500
1500V / 70A

Features:

- Simple construction
- Extremely robust
- High efficiency
- Short circuit proof and unlimited operation with full current in short circuit condition
- Voltage and current regulation with automatic and sharp transition; control mode indicated by LEDs
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- Limitation of inrush current on switching on
- Suitable also for inductive and capacitive loads
- Interlock loop to monitor the external load and internal loop as a standard
- Elapsed-hour meter as a standard

Function:

A transformer is used to transform the mains supply to high voltage. Either on the primary side or on the secondary side of this transformer a phase controlled thyristor rectifier circuit is fitted. A series LC filter is used to smooth the resulting rectified voltage.

Design:

- Depending on voltage and power, the units are built as single or double 19" cabinets of various height. The side covers are detachable, the rear door is lockable.
- All cabinets are equipped with fork-lift-compatible plinths and removable crane-eyes.
- Single 19"- cabinets up to 38U are easily transportable by fork-lift.
- Cooling is carried out via convection or built-in fans, with the air being exhausted (depending upon type) either via the rear or the top.

Output:

- Output isolation:
  The output is floating with isolation voltage ±2000V against earth. Either the positive or the negative terminal may be connected to earth. (Not valid with the option analog programming)
- Output terminals:
  All output terminals are located at the rear side of the cabinet. For Output current up to 10A high voltage connectors with the appropriate dielectric strength are installed. Mating connectors are delivered with the power supply. For higher current feed through terminals or bus bars.

Technical Data:

- Mains connection:
  400V ±10% 47Hz to 53Hz, three-phase
- Ambient temperature:
  0°C to +40°C

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 1% to 100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$
- Residual ripple (0 - 10MHz):
  $<1 \times 10^{-2}$pp + 100mVpp
- Recovery time:
  <100ms to 500ms (depending on type) for load variations of ±10%
- Setting time at nominal load:
  <100ms to 2sec (depending on type) for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load:
  approx. 5sec. to 60sec., depending on type
- Deviation:
  For ±10% mains voltage variation:
  $<\pm 1 \times 10^{-4}$
  For no load / full load:
  $<\pm 1 \times 10^{-3}$
  Over 8 hours under constant conditions:
  $<\pm 3 \times 10^{-4}$
  Within the temperature range:
  $<\pm 3 \times 10^{-4}$/K

Possible Options:

- Analog programming (One of the outputs on “0V” - potential; see also page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Internal resistance setting and regulation (see page 48)
- Power regulation with display (see page 48)
- Roller blades for cabinet units

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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V 0913

Medium voltage power supplies thyristor regulated
Series MYN from 650 V to 2000 V / 7kW to 70 kW

Type	Voltage	Current	Width	Height	Depth	Weight
MYN 21000 - 650	0 - 650 V	0 - 30 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
MYN 28000 - 650	0 - 650 V	0 - 40 A	19" / 600 mm	38 U / 2000 mm	800 mm	600 kg
MYN 35000 - 650	0 - 650 V	0 - 50 A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
MYN 70000 - 650	0 - 650 V	0 - 100 A	19" / 600 mm	38 U / 2000 mm	800 mm	1400 kg
MYN 21000 - 1250	0 - 1250 V	0 - 15 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
MYN 28000 - 1250	0 - 1250 V	0 - 20 A	19" / 600 mm	38 U / 2000 mm	800 mm	600 kg
MYN 35000 - 1250	0 - 1250 V	0 - 25 A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
MYN 70000 - 1250	0 - 1250 V	0 - 50 A	19" / 600 mm	38 U / 2000 mm	800 mm	1400 kg
MYN 21000 - 2000	0 - 2000 V	0 - 10 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
MYN 28000 - 2000	0 - 2000 V	0 - 12 A	19" / 600 mm	38 U / 2000 mm	800 mm	600 kg
MYN 35000 - 2000	0 - 2000 V	0 - 15 A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
MYN 50000 - 2000	0 - 2000 V	0 - 25 A	19" / 600 mm	38 U / 2000 mm	800 mm	1200 kg

Mating high voltage connectors for units with up to 10A output current are included in the scope of delivery. Mating high voltage cables you'll find beginning with page 51.

For units with higher output currents, the output will be carried out according to your wishes so that your load can be optimally connected.

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High voltage power supplies
Series HCP from 3,5 kV to 300 kV / 14 W to 15000 W

Design example **HCP 140 - 12500**
12500V / 10mA

Features:

- Compact size and light weight
- Efficiency approx. 90%
- For units from 12.5kV nominal voltage on, all HV components are moulded in (removable) silicon
- Short-circuit & flashover proof
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with rated power
- Voltage and current regulation with automatic sharp transition, control modes indicated by LEDs
- Adjustable overvoltage protection (limitation of set value)
- 4½ digit DVM's for voltage and current for all models
- Voltage and current setting by means of 10-turn potentiometers with precision scale; the adjusting knob can be locked
- Indication of set point values by means of button for switch-over of the displays
- Set point adjustment possible with locked output, release of output voltage by means of "ON" / "OFF" switch
- Suitable also for inductive and capacitive loads
- Suitable for photomultipliers

Function:

In principle, the rectified line voltage drives a square wave generator of fixed frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For regulation, the square wave voltage is pulse width modulated.
A low residual ripple of the output voltage, together with a high stability, high regulation speed and a low stored energy are all achieved by virtue of the high switching frequency.

Design:

- ½19" or 19" table-top case (depending on output voltage and power).
- 19" Rack-adapters for mounting into a 19" rack are available as accessory.

Output:

- Output isolation:
  The required output polarity must be stated with the order. The requested output polarity will then be available at the HV connector and the "0V" terminal will be firmly connected to earth. If required, the "0V" terminal can be made floating against earth up to ± 300V. A polarity reversal switch is optionally available.
- Output terminals:
  All output terminals are located at the rear side of the unit. High voltage connectors with the appropriate dielectric strength are delivered with the power supply. For nominal voltage of 65kV and higher the HV- plug will be delivered ready mounted to 3m cable.

Technical Data:

- Mains connection:

  Up to 1400W nominal power:
  230V ±10% 47Hz to 63Hz

  For 2800W and higher:
  400V ±10% 47Hz to 63Hz, three-phase
- Ambient temperature:

  0°C to +40°C

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 0,1% to 100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$
- Residual ripple (0 - 10MHz):
  $<1 \times 10^{-4}$pp + 50mVpp,
  typ. 5×10^{-5}pp
- Recovery time:

  Voltage control:
  <1ms for load changes from 10% to 100% or from 100% to 10%

  Current control:
  <10ms for load changes causing an output change of less than 10% of the rated voltage
- Setting time at nominal load:
  <500ms for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load:
  approx. 2sec. to 10sec., depending on type
- Deviation:
  For ±10% mains voltage variation:
  $<\pm 1 \times 10^{-5}$

  For no load / full load:
  $<2 \times 10^{-4}$

  Over 8 hours under constant conditions:
  $<\pm 1 \times 10^{-4}$

  Within the temperature range:
  $<\pm 1{,}5 \times 10^{-4}$/K

Possible Options:

- Coarse/fine-potentiometers (99% / 1%) for more accurate adjustment of voltage and / or current
- Analog programming (see page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Electronically controlled polarity reversal switch (Up to 35kV remotely controllable when ordered with a programming or interface, for higher voltages, please ask us). Please specify the output polarity, when ordering without polarity reversal switch. (see page 48)
- Lower ripple (see page 48)
- Higher stability (see page 48)
- Lower stored energy (see page 48)
- Power limitation (see page 48)

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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V 0913

High voltage power supplies
Series HCP from 3,5 kV to 300 kV / 14 W to 15000 W

Type			Voltage	Current	Width	Height	Depth	Weight
HCP	14 - 3500	●	0 - 3500 V	0 - 4 mA	½19" / 222 mm	3 U / 133 mm	350 mm	3 kg
HCP	35 - 3500	●	0 - 3500 V	0 - 10 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
HCP	140 - 3500	●	0 - 3500 V	0 - 40 mA	½19" / 222 mm	3 U / 133 mm	350 mm	6 kg
HCP	350 - 3500	●	0 - 3500 V	0 - 100 mA	½19" / 222 mm	3 U / 133 mm	450 mm	7 kg
HCP	700 - 3500	●	0 - 3500 V	0 - 200 mA	19" / 443 mm	3 U / 133 mm	350 mm	11 kg
HCP	1400 - 3500	●	0 - 3500 V	0 - 400 mA	19" / 443 mm	3 U / 133 mm	450 mm	13 kg
HCP	2800 - 3500	3)	0 - 3500 V	0 - 800 mA	19" / 443 mm	3 U / 133 mm*	550 mm**	25 kg
HCP	5000 - 3500	3)	0 - 3500 V	0 - 1,5 A	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
HCP	10000 - 3500	3)	0 - 3500 V	0 - 3 A	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
HCP	15000 - 3500	3)	0 - 3500 V	0 - 4,5 A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg
HCP	14 - 6500	●	0 - 6500 V	0 - 2 mA	½19" / 222 mm	3 U / 133 mm	350 mm	3 kg
HCP	35 - 6500	●	0 - 6500 V	0 - 5 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
HCP	140 - 6500	●	0 - 6500 V	0 - 20 mA	½19" / 222 mm	3 U / 133 mm	350 mm	6 kg
HCP	350 - 6500	●	0 - 6500 V	0 - 50 mA	½19" / 222 mm	3 U / 133 mm	450 mm	7 kg
HCP	700 - 6500	●	0 - 6500 V	0 - 100 mA	19" / 443 mm	3 U / 133 mm	350 mm	11 kg
HCP	1400 - 6500	●	0 - 6500 V	0 - 200 mA	19" / 443 mm	3 U / 133 mm	450 mm	13 kg
HCP	2800 - 6500	3)	0 - 6500 V	0 - 400 mA	19" / 443 mm	3 U / 133 mm*	650 mm	25 kg
HCP	5000 - 6500	3)	0 - 6500 V	0 - 750 mA	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
HCP	10000 - 6500	3)	0 - 6500 V	0 - 1,5 A	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
HCP	15000 - 6500	3)	0 - 6500 V	0 - 2,3 A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg
HCP	14 - 12500	●	0 - 12500 V	0 - 1 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
HCP	35 - 12500	●	0 - 12500 V	0 - 2,5 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
HCP	140 - 12500	●	0 - 12500 V	0 - 10 mA	½19" / 222 mm	3 U / 133 mm	350 mm	7 kg
HCP	350 - 12500	●	0 - 12500 V	0 - 25 mA	19" / 443 mm	3 U / 133 mm	450 mm	11 kg
HCP	700 - 12500	●	0 - 12500 V	0 - 50 mA	19" / 443 mm	3 U / 133 mm	550 mm	16 kg
HCP	1400 - 12500	●	0 - 12500 V	0 - 100 mA	19" / 443 mm	3 U / 133 mm	650 mm	21 kg
HCP	2800 - 12500	3)	0 - 12500 V	0 - 200 mA	19" / 443 mm	6 U / 266 mm	550 mm	35 kg
HCP	5000 - 12500	3)	0 - 12500 V	0 - 400 mA	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
HCP	10000 - 12500	3)	0 - 12500 V	0 - 800 mA	19" / 443 mm	9 U / 399 mm	650 mm	75 kg
HCP	15000 - 12500	3)	0 - 12500 V	0 - 1,2 A	19" / 443 mm	12 U / 535 mm	650 mm	110 kg
HCP	14 - 20000	●	0 - 20000 V	0 - 0,6 mA	½19" / 222 mm	3 U / 133 mm	350 mm	4 kg
HCP	35 - 20000	●	0 - 20000 V	0 - 1,5 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
HCP	140 - 20000	●	0 - 20000 V	0 - 6 mA	½19" / 222 mm	3 U / 133 mm	350 mm	7 kg
HCP	350 - 20000	●	0 - 20000 V	0 - 15 mA	19" / 443 mm	3 U / 133 mm	450 mm	11 kg
HCP	700 - 20000	●	0 - 20000 V	0 - 30 mA	19" / 443 mm	3 U / 133 mm	550 mm	16 kg
HCP	1400 - 20000		0 - 20000 V	0 - 60 mA	19" / 443 mm	3 U / 133 mm	650 mm	21 kg
HCP	2800 - 20000	3)	0 - 20000 V	0 - 120 mA	19" / 443 mm	6 U / 266 mm	650 mm	35 kg
HCP	4200 - 20000	3)	0 - 20000 V	0 - 200 mA	19" / 443 mm	6 U / 266 mm	650 mm	45 kg

3) Three phase mains connection

● short term delivery (components on stock)

Mating high voltage connectors are included in the scope of delivery. Other mating high voltage cables you'll find beginning with page 51.

All units up to 35kV optionally available with electronically controlled polarity reversal switch and for 65kV with manually operated polarity reversal switch. For orders without polarity switch please state the required output polarity.

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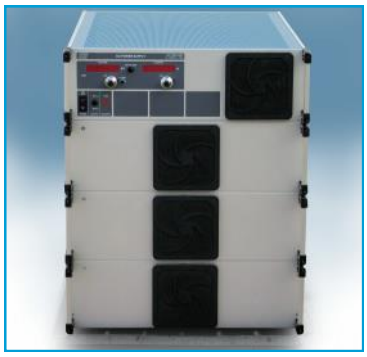
V 0913

High voltage power supplies
Series HCP from 3,5 kV to 300 kV / 14 W to 15000 W



Design example

HCP 15000 - 12500
12500V / 1,2A

Type			Voltage	Current	Width	Height	Depth	Weight
HCP	35 - 35000	●	0 - 35000 V	0 - 1 mA	19" / 443 mm	3 U / 133 mm	450 mm	10 kg
HCP	140 - 35000	●	0 - 35000 V	0 - 4 mA	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
HCP	350 - 35000	●	0 - 35000 V	0 - 10 mA	19" / 443 mm	3 U / 133 mm	450 mm	17 kg
HCP	700 - 35000	●	0 - 35000 V	0 - 20 mA	19" / 443 mm	3 U / 133 mm	550 mm	20 kg
HCP	1400 - 35000		0 - 35000 V	0 - 40 mA	19" / 443 mm	3 U / 133 mm	650 mm	25 kg
HCP	2800 - 35000	3)	0 - 35000 V	0 - 80 mA	19" / 443 mm	6 U / 266 mm	650 mm	45 kg
HCP	4200 - 35000	3)	0 - 35000 V	0 - 120 mA	19" / 443 mm	7 U / 310 mm	650 mm	50 kg
HCP	35 - 65000		0 - 65000 V	0 - 0,5 mA	19" / 443 mm	3 U / 133 mm*	450 mm**	17 kg
HCP	140 - 65000		0 - 65000 V	0 - 2 mA	19" / 443 mm	3 U / 133 mm*	450 mm**	21 kg
HCP	350 - 65000		0 - 65000 V	0 - 5 mA	19" / 443 mm	6 U / 266 mm	450 mm**	45 kg
HCP	700 - 65000		0 - 65000 V	0 - 10 mA	19" / 443 mm	8 U / 355 mm*	550 mm**	55 kg
HCP	1400 - 65000		0 - 65000 V	0 - 20 mA	19" / 443 mm	8 U / 355 mm*	650 mm	70 kg
HCP	2800 - 65000	3)	0 - 65000 V	0 - 40 mA	19" / 443 mm	8 U / 355 mm*	650 mm	80 kg
HCP	140 - 100000		0 - 100000 V	0 - 1 mA	19" / 443 mm	5 U / 221 mm	550 mm	50 kg
HCP	350 - 100000		0 - 100000 V	0 - 3 mA	19" / 443 mm	5 U / 221 mm	550 mm	55 kg
HCP	700 - 100000		0 - 100000 V	0 - 6 mA	19" / 443 mm	8 U / 355 mm	550 mm	73 kg
HCP	1400 - 100000		0 - 100000 V	0 - 12 mA	19" / 443 mm	9 U / 399 mm	550 mm	90 kg
HCP	140 - 150000		0 - 150000 V	0 - 0,5 mA	19" / 443 mm	10 U /433 mm	750 mm	110 kg
HCP	350 - 150000		0 - 150000 V	0 - 2 mA	19" / 443 mm	10 U /433 mm	750 mm	130 kg
HCP	700 - 150000		0 - 150000 V	0 - 4 mA	19" / 443 mm	10 U /433 mm	750 mm	140 kg
HCP	1400 - 150000		0 - 150000 V	0 - 8 mA	19" / 443 mm	12 U /535 mm	750 mm	160 kg
HCP	140 - 200000		0 - 200000 V	0 - 0,4 mA	19" / 443 mm	12 U /535 mm	750 mm	160 kg
HCP	350 - 200000		0 - 200000 V	0 - 1,5 mA	19" / 600 mm	29 U /1500 mm	600 mm	180 kg
HCP	700 - 200000		0 - 200000 V	0 - 3 mA	19" / 600 mm	38 U /2000 mm	800 mm	200 kg
HCP	1400 - 200000		0 - 200000 V	0 - 6 mA	19" / 600 mm	38 U /2000 mm	800 mm	220 kg
HCP	140 - 300000		0 - 300000 V	0 - 0,3 mA	19" / 600 mm	29 U /1500 mm	750 mm	180 kg
HCP	350 - 300000		0 - 300000 V	0 - 1 mA	19" / 600 mm	38 U /1500 mm	600 mm	200 kg
HCP	700 - 300000		0 - 300000 V	0 - 2 mA	19" / 600 mm	38 U /2000 mm	800 mm	220 kg
HCP	1400 - 300000		0 - 300000 V	0 - 4 mA	19" / 600 mm	38 U /2000 mm	800 mm	250 kg

*) With polarity reversal switch these units will be 2U higher.

**) With polarity reversal switch these units will be 100mm deeper.

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V 0913

High voltage power supplies, high power
Series HCH from 650 V to 300 kV / to 50 kW

Design example

HCH 50000 - 20000
20kV / 2,5A

Features:

- Efficiency up to 90%
- Short-circuit & flashover proof
- In units up to 20kV nominal voltage, the HV-components are isolated in air. From 35kV on the isolation is with oil.
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with rated power
- Voltage and current regulation with automatic sharp transition, control modes indicated by LEDs
- Limitation of inrush current on switching on
- Voltage and current setting by means of 10-turn potentiometers with precision scale; the adjusting knob can be locked
- Interlock loop to monitor the external load and internal loop as a standard

Function:

In principle, the rectified line voltage drives a square wave generator of fixed frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For regulation, the square wave voltage is pulse width modulated.

Design:

- Depending on Voltage and Power the units are built as single or double 19" cabinets, or as a oil- filled HV container with the power electronics on the top or in a separate rack.

Output:

- Output isolation:
  The required output polarity must be stated with the order. The requested output polarity will then be available at the HV connector and the “0V” terminal will be firmly connected to earth. If required, the "0V" terminal can be made floating against earth up to ± 50V. A polarity reversal switch is optionally available.
- Output terminals:
  All output terminals are located at the rear side of the cabinet or at the top of the HV container. High voltage connectors with the appropriate dielectric strength are delivered with the power supply for units with output current up to 10A. For units with higher output currents, the output will be carried out according to your wishes so that your load can be optimally connected.

For nominal voltage of 65kV and higher the HV- plug will be delivered ready mounted to 10m cable.

Technical Data:

- Mains connection:
  Up to 1400W nominal power:
  230V ±10% 47Hz to 63Hz
  For 2800W and higher:
  400V ±10% 47Hz to 63Hz, three-phase
- Ambient temperature:
  0°C to +40°C

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 0,1% to 100%
- Setting resolution:
  ±1 x 10^{-4}
- Residual ripple (0 - 10 MHz):
  <2 x 10^{-3}pp + 50mVpp
- Recovery time:
  Voltage control:
  <1ms for load changes from 10% to 100% or from 100% to 10%
  Current control:
  <10ms for load changes causing an output change of less than 10% of the rated voltage
- Setting time at nominal load:
  <500ms for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load:
  approx. 1sec. to 10sec., depending on type
- Deviation:
  For ±10% mains voltage variation:
  <± 1 x 10^{-4}
  For no load / full load:
  <5 x 10^{-4}
  Over 8 hours under constant conditions:
  <±2 x 10^{-4}
  Within the temperature range:
  <±1,5 x 10^{-4} /K

Possible Options:

- Analog programming (see page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 44)
- Polarity reversal switch. Please specify the output polarity, when ordering without polarity reversal switch. (see page 48)
- Lower ripple (see page 48)
- Higher stability (see page 48)
- Shorter setting time (see page 48)
- Roller blades for cabinet units

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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V 0913

High voltage power supplies, high power
Series HCH from 650 V to 300 kV / to 50 kW

Type			Voltage			Current			Width	Height	Depth	Weight
HCH	20000 - 650	3)	0 -	650	V	0 -	30	A	19" / 600 mm	29 U / 1500 mm	600 mm	240 kg
HCH	30000 - 650	3)	0 -	650	V	0 -	45	A	19" / 600 mm	38 U / 2000 mm	800 mm	300 kg
HCH	40000 - 650	3)	0 -	650	V	0 -	60	A	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCH	50000 - 650	3)	0 -	650	V	0 -	75	A	19" / 600 mm	38 U / 2000 mm	800 mm	420 kg
HCH	20000 - 1250	3)	0 -	1250	V	0 -	16	A	19" / 600 mm	29 U / 1500 mm	600 mm	240 kg
HCH	30000 - 1250	3)	0 -	1250	V	0 -	24	A	19" / 600 mm	38 U / 2000 mm	800 mm	300 kg
HCH	40000 - 1250	3)	0 -	1250	V	0 -	32	A	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCH	50000 - 1250	3)	0 -	1250	V	0 -	40	A	19" / 600 mm	38 U / 2000 mm	800 mm	420 kg
HCH	20000 - 2000	3)	0 -	2000	V	0 -	10	A	19" / 600 mm	29 U / 1500 mm	600 mm	240 kg
HCH	30000 - 2000	3)	0 -	2000	V	0 -	15	A	19" / 600 mm	38 U / 2000 mm	800 mm	300 kg
HCH	40000 - 2000	3)	0 -	2000	V	0 -	20	A	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCH	50000 - 2000	3)	0 -	2000	V	0 -	25	A	19" / 600 mm	38 U / 2000 mm	800 mm	420 kg
HCH	20000 - 3500	3)	0 -	3500	V	0 -	6	A	19" / 600 mm	29 U / 1500 mm	600 mm	240 kg
HCH	30000 - 3500	3)	0 -	3500	V	0 -	8	A	19" / 600 mm	38 U / 2000 mm	800 mm	300 kg
HCH	40000 - 3500	3)	0 -	3500	V	0 -	12	A	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCH	50000 - 3500	3)	0 -	3500	V	0 -	15	A	19" / 600 mm	38 U / 2000 mm	800 mm	420 kg
HCH	20000 - 6500	3)	0 -	6500	V	0 -	3	A	19" / 600 mm	29 U / 1500 mm	600 mm	240 kg
HCH	30000 - 6500	3)	0 -	6500	V	0 -	4	A	19" / 600 mm	38 U / 2000 mm	800 mm	300 kg
HCH	40000 - 6500	3)	0 -	6500	V	0 -	6	A	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCH	50000 - 6500	3)	0 -	6500	V	0 -	7,5	A	19" / 600 mm	38 U / 2000 mm	800 mm	420 kg
HCH	20000 - 12500	3)	0 -	12500	V	0 -	1,6	A	19" / 600 mm	29 U / 1500 mm	600 mm	240 kg
HCH	30000 - 12500	3)	0 -	12500	V	0 -	2,4	A	19" / 600 mm	38 U / 2000 mm	800 mm	300 kg
HCH	40000 - 12500	3)	0 -	12500	V	0 -	3,2	A	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCH	50000 - 12500	3)	0 -	12500	V	0 -	4	A	2x 19" / 1200 mm	38 U / 2000 mm	800 mm	480 kg
HCH	10000 - 20000	3)	0 -	20000	V	0 -	500	mA	19" / 600 mm	29 U / 1500 mm	600 mm	120 kg
HCH	15000 - 20000	3)	0 -	20000	V	0 -	750	mA	19" / 600 mm	29 U / 1500 mm	600 mm	170 kg
HCH	20000 - 20000	3)	0 -	20000	V	0 -	1	A	19" / 600 mm	38 U / 2000 mm	800 mm	240 kg
HCH	30000 - 20000	3)	0 -	20000	V	0 -	1,5	A	19" / 600 mm	38 U / 2000 mm	800 mm	300 kg
HCH	40000 - 20000	3)	0 -	20000	V	0 -	2	A	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCH	50000 - 20000	3)	0 -	20000	V	0 -	2,5	A	2x 19" / 1200 mm	38 U / 2000 mm	800 mm	480 kg
HCH	10000 - 35000	3)	0 -	35000	V	0 -	300	mA	19" / 600 mm	38 U / 2000 mm	800 mm	390 kg
HCH	15000 - 35000	3)	0 -	35000	V	0 -	400	mA	19" / 600 mm	38 U / 2000 mm	800 mm	420 kg
HCH	20000 - 35000	3)	0 -	35000	V	0 -	600	mA	19" / 600 mm	38 U / 2000 mm	800 mm	450 kg
HCH	30000 - 35000	3)	0 -	35000	V	0 -	800	mA	2x 19" / 1200 mm	38 U / 2000 mm	800 mm	640 kg
HCH	40000 - 35000	3)	0 -	35000	V	0 -	1,2	A	2x 19" / 1200 mm	38 U / 2000 mm	800 mm	720 kg
HCH	50000 - 35000	3)	0 -	35000	V	0 -	1,5	A	2x 19" / 1200 mm	38 U / 2000 mm	800 mm	790 kg

3) Three phase mains connection

Mating high voltage connectors for units with up to 10A output current are included in the scope of delivery. Mating high voltage cables you'll find beginning with page 51. For units with higher output currents, the output will be carried out according to your wishes so that your load can be optimally connected.

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V 0913

High voltage power supplies, high power
Series HCH from 650 V to 300 kV / to 50 kW

Type			Voltage			Current		Width	Height	Depth	Weight
HCH	4200 - 65000	3)	0 - 65000 V	0 -	60 mA	700 mm*	750 mm*	630 mm*	240 kg		
HCH	10000 - 65000	3)	0 - 65000 V	0 -	150 mA	19" / 600 mm	38 U / 2000 mm	800 mm	460 kg		
HCH	15000 - 65000	3)	0 - 65000 V	0 -	200 mA	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg		
HCH	20000 - 65000	3)	0 - 65000 V	0 -	300 mA	19" / 600 mm	38 U / 2000 mm	800 mm	500 kg		
HCH	30000 - 65000	3)	0 - 65000 V	0 -	400 mA	19" / 600 mm	29 U / 1500 mm	600 mm**	170/430 kg		
HCH	40000 - 65000	3)	0 - 65000 V	0 -	600 mA	19" / 600 mm	29 U / 1500 mm	600 mm**	200/470 kg		
HCH	50000 - 65000	3)	0 - 65000 V	0 -	750 mA	19" / 600 mm	38 U / 2000 mm	800 mm**	250/500 kg		
HCH	2800 - 100000	3)	0 - 100000 V	0 -	25 mA	800 mm*	1200 mm*	760 mm*	550 kg		
HCH	4200 - 100000	3)	0 - 100000 V	0 -	40 mA	800 mm*	1200 mm*	760 mm*	550 kg		
HCH	10000 - 100000	3)	0 - 100000 V	0 -	100 mA	19" / 600 mm	38 U / 2000 mm	800 mm	500 kg		
HCH	15000 - 100000	3)	0 - 100000 V	0 -	150 mA	19" / 600 mm	38 U / 2000 mm	800 mm	520 kg		
HCH	20000 - 100000	3)	0 - 100000 V	0 -	200 mA	19" / 600 mm	38 U / 2000 mm	800 mm	545 kg		
HCH	30000 - 100000	3)	0 - 100000 V	0 -	300 mA	19" / 600 mm	29 U / 1500 mm	600 mm**	170/500 kg		
HCH	40000 - 100000	3)	0 - 100000 V	0 -	400 mA	19" / 600 mm	31 U / 2000 mm	600 mm**	200/550 kg		
HCH	50000 - 100000	3)	0 - 100000 V	0 -	500 mA	19" / 600 mm	38 U /2000 mm	800 mm**	250/600 kg		
HCH	2800 - 150000	3)	0 - 150000 V	0 -	15 mA	800 mm*	1400 mm*	760 mm*	760 kg		
HCH	4200 - 150000	3)	0 - 150000 V	0 -	25 mA	800 mm*	1400 mm*	760 mm*	760 kg		
HCH	10000 - 150000	3)	0 - 150000 V	0 -	60 mA	19" / 600 mm	20 U / 1100 mm	600 mm**	100/600 kg		
HCH	15000 - 150000	3)	0 - 150000 V	0 -	100 mA	19" / 600 mm	20 U / 1100 mm	600 mm**	115/600 kg		
HCH	20000 - 150000	3)	0 - 150000 V	0 -	130 mA	19" / 600 mm	29 U / 1500 mm	600 mm**	150/680 kg		
HCH	30000 - 150000	3)	0 - 150000 V	0 -	200 mA	19" / 600 mm	29 U / 1500 mm	600 mm**	170/680 kg		
HCH	40000 - 150000	3)	0 - 150000 V	0 -	250 mA	19" / 600 mm	29 U / 1500 mm	800 mm**	200/680 kg		
HCH	50000 - 150000	3)	0 - 150000 V	0 -	300 mA	19" / 600 mm	38 U / 2000 mm	800 mm**	250/680 kg		
HCH	2800 - 200000	3)	0 - 200000 V	0 -	12 mA	955 mm*	1650 mm*	850 mm*	960 kg		
HCH	4200 - 200000	3)	0 - 200000 V	0 -	20 mA	955 mm*	1830 mm*	850 mm*	1000 kg		
HCH	10000 - 200000	3)	0 - 200000 V	0 -	50 mA	19" / 600 mm	20 U / 1100 mm	600 mm**	100/650 kg		
HCH	15000 - 200000	3)	0 - 200000 V	0 -	75 mA	19" / 600 mm	20 U / 1100 mm	600 mm**	115/650 kg		
HCH	20000 - 200000	3)	0 - 200000 V	0 -	100 mA	19" / 600 mm	29 U / 1500 mm	600 mm**	150/750 kg		
HCH	30000 - 200000	3)	0 - 200000 V	0 -	150 mA	19" / 600 mm	29 U / 1500 mm	600 mm**	170/750 kg		
HCH	40000 - 200000	3)	0 - 200000 V	0 -	200 mA	19" / 600 mm	29 U / 1500 mm	600 mm**	200/850 kg		
HCH	50000 - 200000	3)	0 - 200000 V	0 -	250 mA	19" / 600 mm	38 U / 2000 mm	800 mm**	250/850 kg		
HCH	2800 - 300000	3)	0 - 300000 V	0 -	8 mA	1500 mm*	1000 mm*	1500 mm*	1700 kg		
HCH	4200 - 300000	3)	0 - 300000 V	0 -	12 mA	1500 mm*	1000 mm*	1500 mm*	1700 kg		
HCH	10000 - 300000	3)	0 - 300000 V	0 -	30 mA	Dimensions and weight on request					
HCH	15000 - 300000	3)	0 - 300000 V	0 -	50 mA	Dimensions and weight on request					
HCH	20000 - 300000	3)	0 - 300000 V	0 -	65 mA	Dimensions and weight on request					
HCH	30000 - 300000	3)	0 - 300000 V	0 -	100 mA	Dimensions and weight on request					
HCH	40000 - 300000	3)	0 - 300000 V	0 -	130 mA	Dimensions and weight on request					
HCH	50000 - 300000	3)	0 - 300000 V	0 -	160 mA	Dimensions and weight on request					

Mating high voltage connectors for these units are in scope of delivery. Mating high voltage cables you'll find beginning with page 51. For units with higher output currents, the output will be carried out according to your wishes so that your load can be optimally connected.
HCH power supplies, over 65kV, are provided along with 10m output cable.

*) The dimensions are valid for the high voltage part with power part. on top. They are non-binding guidelines.

**) The dimensions are valid for the power part. The high voltage part is housed in a separate oil filled container. Weight is stated: Power part / High voltage container

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High voltage power supplies thyristor regulated
Series HYN from 3,5 kV to 20 kV / 21kW to 50 kW

Design example

HYN 35000 - 3500
3,5kV / 10A

Features:

- Simple construction
- Extremely robust
- High efficiency
- Short circuit proof and unlimited operation with full current in short circuit condition
- Voltage and current regulation with automatic and sharp transition; control modes indicated by LEDs
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- Limitation of inrush current on switching on
- Suitable also for inductive and capacitive loads
- Interlock loop to monitor the external load and internal loop as a standard
- Elapsed-hour meter as a standard

Function:

The mains voltage is transformed to high voltage potential. Either on the primary side or on the secondary side, a phase cutting circuit with thyristors is installed. The rectified voltage is smoothed by a LC - filter.

Design:

- Depending on voltage and power the units are built as single or double 19" cabinets of various height. The side covers are detachable, the rear door is lockable.
- All cabinets are equipped with fork-lift-compatible plinths and removable crane-eyes.
- Single 19"- cabinets up to 38U are easily transportable by fork-lift.
- Cooling is carried out via convection or built-in fans, with the air being exhausted (depending upon type) either via the rear or the top.

Output:

- Output isolation:
  The required output polarity must be stated with the order. The requested output polarity will then be available at the HV connector and the "0V" terminal will be firmly connected to earth. A polarity reversal switch is optionally available.
- Output terminals:
  All output terminals are located at the rear side of the cabinet. For Output current up to 10A high voltage connectors with the appropriate dielectric strength are installed. Mating connectors are delivered with the power supply.

Technical Data:

- Mains connection:
  400V ±10% 47Hz to 53Hz, three-phase
- Ambient temperature:
  0°C to +40°C

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 1% to 100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$
- Residual ripple:
  $<1 \times 10^{-2}$pp + 100mVpp
- Recovery time:
  <100ms to 500ms (depending on type) for load variations of ±10%
- Setting time at nominal load:
  <100ms to 2sec (depending on type) for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load:
  approx. 5sec. to 60sec., depending on type
- Deviation:
  For ±10% mains voltage variation:
  $<\pm 1 \times 10^{-4}$
  For no load / full load:
  $<\pm 1 \times 10^{-3}$
  Over 8 hours under constant conditions:
  $<\pm 3 \times 10^{-4}$
  Within the temperature range:
  $<\pm 3 \times 10^{-4}$ / K

Possible Options:

- Analog programming (see page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, LAN,USB (more on request) (see page 46)
- Polarity reversal switch. Please specify the output polarity, when ordering without polarity reversal switch. (see page 48)
- Internal resistance setting and regulation (see page 48)
- Power regulation with display (see page 48)
- Roller blades for cabinet units

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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V 0913

High voltage power supplies thyristor regulated
Series HYN from 3,5 kV to 20 kV / 21 kW to 50 kW

Design example

HYN 200000 - 20000
20kV / 10A
special version,
customised design,
with 20A load capacity

Type	Voltage	Current	Width	Height	Depth	Weight
HYN 21000 - 3500	0 - 3500 V	0 - 6 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
HYN 28000 - 3500	0 - 3500 V	0 - 8 A	19" / 600 mm	38 U / 2000 mm	800 mm	600 kg
HYN 35000 - 3500	0 - 3500 V	0 - 10 A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
HYN 70000 - 3500	0 - 3500 V	0 - 20 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1400 kg
HYN 21000 - 6500	0 - 6500 V	0 - 3 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
HYN 28000 - 6500	0 - 6500 V	0 - 4 A	19" / 600 mm	38 U / 2000 mm	800 mm	600 kg
HYN 35000 - 6500	0 - 6500 V	0 - 5 A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
HYN 70000 - 6500	0 - 6500 V	0 - 10 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1400 kg
HYN 21000 - 12500	0 - 12500 V	0 - 1,5 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
HYN 28000 - 12500	0 - 12500 V	0 - 2 A	19" / 600 mm	38 U / 2000 mm	800 mm	600 kg
HYN 35000 - 12500	0 - 12500 V	0 - 2,5 A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
HYN 50000 - 12500	0 - 12500 V	0 - 4 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1200 kg
HYN 7000 - 20000	0 - 20000 V	0 - 300 mA	19" / 600 mm	29 U / 1500 mm	600 mm	230 kg
HYN 10500 - 20000	0 - 20000 V	0 - 500 mA	19" / 600 mm	29 U / 1500 mm	600 mm	340 kg
HYN 14000 - 20000	0 - 20000 V	0 - 600 mA	19" / 600 mm	38 U / 2000 mm	800 mm	400 kg
HYN 21000 - 20000	0 - 20000 V	0 - 1 A	19" / 600 mm	38 U / 2000 mm	800 mm	480 kg
HYN 28000 - 20000	0 - 20000 V	0 - 1,2 A	19" / 600 mm	38 U / 2000 mm	800 mm	600 kg
HYN 35000 - 20000	0 - 20000 V	0 - 1,5 A	19" / 600 mm	38 U / 2000 mm	800 mm	800 kg
HYN 50000 - 20000	0 - 20000 V	0 - 2,5 A	2 x 19" / 1200 mm	38 U / 2000 mm	800 mm	1200 kg

Mating high voltage connectors for units with up to 10A output current are included in the scope of delivery. Mating high voltage cables you'll find beginning with page 51.

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High voltage cassette power supplies EURO-size
Series HCE from 125 V to 35 kV / 7 W to 350 W

Design example

HCE 7 - 12500
12,5kV / 0,5mA
positive

HCE 35 - 35000
35kV / 1mA
negative

HCE 7 - 3500
3,5kV / 2mA
positive (2 units)

HCE 350 - 2000
2kV / 150mA
positive

Features:

- Compact size
- Light-weight
- For units from 6.5kV nominal voltage on, all HV components are moulded in (removable) silicon
- Short circuit and flashover proof
- Unlimited operation with rated current in a short-circuit condition
- Unlimited operation with rated power
- Voltage or current regulation with automatic transition.
- Control mode indicated by LEDs
- Screwdriver adjustment of voltage and current on the front panel
- Standard analog programming plus HV ON/OFF input and monitor outputs
- Measuring terminals for voltage and current monitors on the front panel
- Suitable for use with capacitive loads
- Suitable for use with photomultipliers

Option:

- Ten turn potentiometer for voltage on the front panel.

Function:

In principle, the rectified line voltage drives a square wave generator of fixed frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For regulation, the square wave voltage is pulse width modulated.

Design:

- EURO-cassette design. Width depending on type.
- 19" frames are available as an option.

Output:

- Output isolation:
  The polarity is positive or negative and has to be indicated with the order. The "0V" - terminal of the output is connected to earth but may be disconnected as needed. When disconnected, the "0V" (earthy) terminal may float with respect to earth up to ±125V.
- Output terminals:
  Outputs are located on the rear of the units. For units up to 650V nominal voltage, the output is on 4mm safety connectors.
  From 1250V nominal voltage on, HV-connectors are provided. The mating HV-connectors are delivered with the unit.

Technical Data:

- Mains connection:
  230V ±10% 47Hz to 63Hz
- Ambient temperature:
  0°C to +40°C

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from approx. 0,1% to 100%
- Setting resolution:
  ±1 x 10^{-4}
- Residual ripple (0-10MHZ):
  In CV mode:
  <1 x 10^{-4}pp + 50mVpp,
  typ. 5 x 10^{-5}pp
  In CC mode:
  <5 x 10^{-4}pp + 50mVpp
- Recovery time:
  Voltage control:
  <1ms for load changes from 10% to 100% or from 100% to 10%
  Current control:
  <10ms for load changes causing an output change of less than 10% of the rated voltage
- Setting time at nominal load:
  <200ms for changes of the output voltage from 10% to 90% or 90% to 10%
- Discharge time constant for output without load:
  approx. 0,5sec. to 5sec., depending on type
- Deviation:
  For ±10% mains voltage variation:
  <± 1 x 10^{-5}
  For no load / full load:
  <2 x 10^{-4}
  Over 8 hours under constant conditions:
  <±1 x 10^{-4}
  Within the temperature range:
  <±1,5 x 10^{-4} /K

Voltage and current adjustment by screwdriver or via analog programming.

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V 0913

High voltage cassette power supplies EURO-size
Series HCE from 125 V to 35 kV / 7 W to 350 W

Rear side with mains connection, high voltage output and analog programming as a standard

Optionally, the front plane can be equipped with a ten turn potentiometer for voltage adjustment.

	Type			Voltage			Current		Width	Height	Depth	Weight
HCE	7 - 125	●	0 -	125	V	0 -	50	mA	14 U / 71 mm	3 U / 133 mm	170 mm	1,2 kg
HCE	35 - 125	●	0 -	125	V	0 -	250	mA	21 U / 107 mm	3 U / 133 mm	170 mm	1,5 kg
HCE	140 - 125		0 -	125	V	0 -	1	A	21 U / 107 mm	6 U / 262 mm	230 mm	3,0 kg
HCE	350 - 125		0 -	125	V	0 -	2,5	A	21 U / 107 mm	6 U / 262 mm	230 mm	4,0 kg
HCE	7 - 200	●	0 -	200	V	0 -	30	mA	14 U / 71 mm	3 U / 133 mm	170 mm	1,2 kg
HCE	35 - 200	●	0 -	200	V	0 -	150	mA	21 U / 107 mm	3 U / 133 mm	170 mm	1,5 kg
HCE	140 - 200		0 -	200	V	0 -	600	mA	21 U / 107 mm	6 U / 262 mm	230 mm	3,0 kg
HCE	350 - 200		0 -	200	V	0 -	1,5	A	21 U / 107 mm	6 U / 262 mm	230 mm	4,0 kg
HCE	7 - 350	●	0 -	350	V	0 -	20	mA	14 U / 71 mm	3 U / 133 mm	170 mm	1,2 kg
HCE	35 - 350	●	0 -	350	V	0 -	100	mA	21 U / 107 mm	3 U / 133 mm	170 mm	1,5 kg
HCE	140 - 350		0 -	350	V	0 -	400	mA	21 U / 107 mm	6 U / 262 mm	230 mm	3,0 kg
HCE	350 - 350		0 -	350	V	0 -	1	A	21 U / 107 mm	6 U / 262 mm	230 mm	4,0 kg
HCE	7 - 650	●	0 -	650	V	0 -	10	mA	14 U / 71 mm	3 U / 133 mm	170 mm	1,2 kg
HCE	35 - 650	●	0 -	650	V	0 -	50	mA	21 U / 107 mm	3 U / 133 mm	170 mm	1,5 kg
HCE	140 - 650		0 -	650	V	0 -	200	mA	21 U / 107 mm	6 U / 262 mm	230 mm	3,0 kg
HCE	350 - 650		0 -	650	V	0 -	500	mA	21 U / 107 mm	6 U / 262 mm	230 mm	4,0 kg
HCE	7 - 1250	●	0 -	1250	V	0 -	5	mA	14 U / 71 mm	3 U / 133 mm	170 mm	1,2 kg
HCE	35 - 1250	●	0 -	1250	V	0 -	25	mA	21 U / 107 mm	3 U / 133 mm	170 mm	1,5 kg
HCE	140 - 1250		0 -	1250	V	0 -	100	mA	21 U / 107 mm	6 U / 262 mm	230 mm	3,0 kg
HCE	350 - 1250		0 -	1250	V	0 -	250	mA	21 U / 107 mm	6 U / 262 mm	230 mm	4,0 kg
HCE	7 - 2000	●	0 -	2000	V	0 -	3	mA	14 U / 71 mm	3 U / 133 mm	170 mm	1,2 kg
HCE	35 - 2000	●	0 -	2000	V	0 -	15	mA	21 U / 107 mm	3 U / 133 mm	170 mm	1,5 kg
HCE	140 - 2000		0 -	2000	V	0 -	60	mA	21 U / 107 mm	6 U / 262 mm	230 mm	3,0 kg
HCE	350 - 2000		0 -	2000	V	0 -	150	mA	21 U / 107 mm	6 U / 262 mm	230 mm	4,0 kg

● short term delivery (components on stock)

For 1250V and higher, mating high voltage connectors are included in the scope of delivery. Mating high voltage cables you'll find beginning with page 51.

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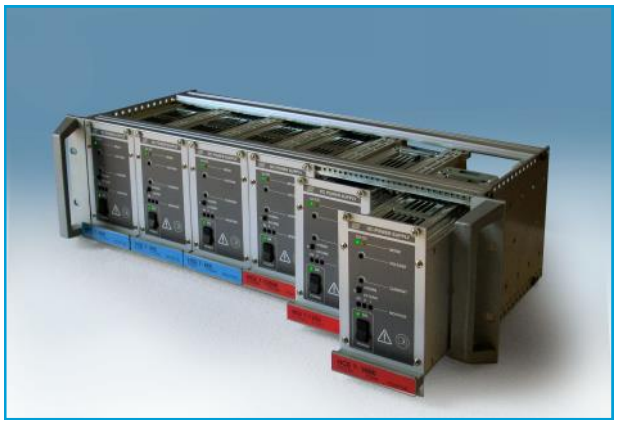
V 0913

High voltage cassette power supplies EURO-size
Series HCE from 125 V to 35 kV / 7 W to 350 W



19“-(84U) frames are available as accessory

Type				Voltage			Current			Width	Height	Depth	Weight
HCE	7 - 3500	●	0 -	3500	V	0 -	2	mA	14 U / 71	mm	3 U / 133 mm	170 mm	1,2 kg
HCE	35 - 3500	●	0 -	3500	V	0 -	10	mA	21 U / 107	mm	3 U / 133 mm	170 mm	1,5 kg
HCE	140 - 3500		0 -	3500	V	0 -	40	mA	21 U / 107	mm	6 U / 262 mm	230 mm	3,0 kg
HCE	350 - 3500		0 -	3500	V	0 -	100	mA	28 U / 142	mm	6 U / 262 mm	230 mm	4,0 kg
HCE	7 - 6500	●	0 -	6500	V	0 -	1	mA	14 U / 71	mm	3 U / 133 mm	170 mm	1,3 kg
HCE	35 - 6500	●	0 -	6500	V	0 -	5	mA	21 U / 107	mm	3 U / 133 mm	170 mm	1,5 kg
HCE	140 - 6500		0 -	6500	V	0 -	20	mA	21 U / 107	mm	6 U / 262 mm	230 mm	5,0 kg
HCE	350 - 6500		0 -	6500	V	0 -	50	mA	28 U / 142	mm	6 U / 262 mm	230 mm	6,0 kg
HCE	7 - 12500	●	0 -	12500	V	0 -	0,5	mA	14 U / 71	mm	3 U / 133 mm	170 mm	1,3 kg
HCE	35 - 12500	●	0 -	12500	V	0 -	2,5	mA	21 U / 107	mm	3 U / 133 mm	170 mm	1,8 kg
HCE	140 - 12500		0 -	12500	V	0 -	10	mA	28 U / 142	mm	6 U / 262 mm	230 mm	5,0 kg
HCE	350 - 12500		0 -	12500	V	0 -	25	mA	28 U / 142	mm	6 U / 262 mm	230 mm	6,0 kg
HCE	7 - 20000	●	0 -	20000	V	0 -	0,3	mA	21 U / 107	mm	3 U / 133 mm	170 mm	2,3 kg
HCE	35 - 20000	●	0 -	20000	V	0 -	1,5	mA	21 U / 107	mm	3 U / 133 mm	170 mm	2,5 kg
HCE	140 - 20000		0 -	20000	V	0 -	6	mA	28 U / 142	mm	6 U / 262 mm	230 mm	5,0 kg
HCE	350 - 20000		0 -	20000	V	0 -	15	mA	28 U / 142	mm	6 U / 262 mm	230 mm	6,0 kg
HCE	7 - 35000	●	0 -	35000	V	0 -	0,2	mA	28 U / 142	mm	3 U / 133 mm	170 mm	2,5 kg
HCE	35 - 35000	●	0 -	35000	V	0 -	1	mA	28 U / 142	mm	3 U / 133 mm	170 mm	2,8 kg
HCE	140 - 35000		0 -	35000	V	0 -	4	mA	28 U / 142	mm	6 U / 262 mm	230 mm	5,0 kg
HCE	350 - 35000		0 -	35000	V	0 -	10	mA	28 U / 142	mm	6 U / 262 mm	230 mm	6,0 kg

● short term delivery (components on stock)

For 1250V and higher, mating high voltage connectors are included in the scope of delivery. Mating high voltage cables you‘ll find beginning with page 51.

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V 0913

Capacitor charging power supplies
Series HCK from 2 kV to 65 kV / 100 J/s to 20 kJ/s

Design example

HCK 200 - 12500
12500V / 30mA

Features:

- Efficiency approx. 90%
- In units of 20kV and higher, the HV-components are moulded in (removable) silicon resin. From 35kV / 5000J/s on, the HV-components are isolated in oil
- Continuous charging or triggered charging via potential free external trigger input selectable (opto-coupler input for 12 - 24V).
- Charging with adjustable constant current without overshoot.
- Voltage and current setting by 10-turn potentiometers with precision scale; the adjusting knob can be locked
- Suitable for continuous or compensation charging
- No external protection resistor is required
- Permanent short-circuit proof
- 4½ digit DVM for charging current and output voltage (for table-top models)
- Pre-selection of the output voltage with display
- End of charge signal, when the final voltage is reached, via front panel LED and a potential-free interface for signalling to an external control system (opto-coupler output)
- Suitable for capacitive loads with resistive elements
- The nominal current can be permanently supplied at maximum output voltage

Function:

The capacitor charging high voltage DC power supplies are designed specifically to the requirements of capacitor charging or capacitor conditioning, i.e. they have a more heavily designed output resistor to withstand a pulsed load and a regulating circuit, optimized for fast switching over between current and voltage regulation and vice versa.
In principle, the rectified line voltage drives a square wave generator of fixed frequency, whose AC voltage is transformed, rectified and filtered, producing the output voltage. For regulation, the square wave voltage is pulse width modulated.

Design:

Up to 2500J/s nominal power 19" table-top case, higher power in 19" cabinets (depending on type) with oil isolated external HV-container.

Output:

- Output isolation:
  The polarity is positive or negative and has to be indicated with the order.
  The "0V"- terminal of the output is connected to earth but may be disconnected as needed. When disconnected, the "0V" (earthy) terminal may float with respect to earth up to ±300V.
- Output terminals:
  For all HCK units the output is on the rear side of the unit or on a separate HV-container. Mating HV-connectors are included, from 35kV on, assembled with 3m cable, from 65kV >5000J/s on with 10m cable.

Technical Data:

- Mains connection:

  Up to 800J/s nominal power:
  230V ±10% 47Hz to 63Hz;

  From nominal power 1600J/s
  400V ±10% 47Hz to 63Hz, three-phase
- Ambient temperature:
  0°C to +40°C
- Charging power:
  The specified max. charging power (see table) will be supplied for charging between "0" and the rated voltage. For charging of a partially discharged capacitor a considerably higher charging power, up to the double, can be supplied.
- Setting range for the charging voltage:
  from approx. 1% to 100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$
- Reproducibility of the charging voltage with respect to the rated value:
  For ±10% mains voltage variation:
  $< \pm 1 \times 10^{-4}$
  Over 8 hours under constant conditions:
  $< \pm 1 \times 10^{-3}$
  Within the temperature range:
  $< \pm 2 \times 10^{-4}$ /K
  For a repetition frequency of <10Hz:
  $< \pm 1 \times 10^{-3}$
  For a repetition frequency of >10Hz:
  $< \pm 1 \times 10^{-2}$
- Repetition frequency:
  max. 100Hz
- Residual ripple of the charging current:
  approx. 10%pp 20kHz/40kHz)

Possible Options:

- Analog programming (see page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, LAN, USB (more on request) (see page 46)
- Polarity reversal switch available up to 1600J/s (by request for higher powers) Please specify the output polarity, when ordering without polarity reversal switch. (see page 48)
- Dump switch for the output & the load
- Higher repetition frequency
- Built-in or external discharge circuit for pulse operation
- Higher stability and better reproducibility (see page 48)
- Roller blades for cabinet units

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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Capacitor charging power supplies
Series HCK from 2 kV to 65 kV / 100 J/s to 20 kJ/s

Type			Voltage		Current	Charg. pow.	Width	Height	Depth	Weight
HCK	100 - 2000		0 - 2000 V	0 -	100 mA	100 J/s	19" / 443 mm	3 U / 133 mm	350 mm	6 kg
HCK	200 - 2000		0 - 2000 V	0 -	200 mA	200 J/s	19" / 443 mm	3 U / 133 mm	350 mm	7 kg
HCK	400 - 2000		0 - 2000 V	0 -	400 mA	400 J/s	19" / 443 mm	3 U / 133 mm	350 mm	11 kg
HCK	800 - 2000		0 - 2000 V	0 -	800 mA	800 J/s	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
HCK	1600 - 2000	3)	0 - 2000 V	0 -	1,6 A	1600 J/s	19" / 443 mm	6 U / 266 mm	650 mm	25 kg
HCK	2500 - 2000	3)	0 - 2000 V	0 -	2,5 A	2500 J/s	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
HCK	5000 - 2000	3)	0 - 2000 V	0 -	5 A	5000 J/s	19" / 600 mm	9 U / 399 mm	650 mm	75 kg
HCK	7500 - 2000	3)	0 - 2000 V	0 -	7,5 A	7500 J/s	19" / 600 mm	12 U / 535 mm	650 mm	110 kg
HCK	10000 - 2000	3)	0 - 2000 V	0 -	10 A	10000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	240 kg
HCK	20000 - 2000	3)	0 - 2000 V	0 -	20 A	20000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCK	100 - 3500		0 - 3500 V	0 -	50 mA	100 J/s	19" / 443 mm	3 U / 133 mm	350 mm	6 kg
HCK	200 - 3500		0 - 3500 V	0 -	100 mA	200 J/s	19" / 443 mm	3 U / 133 mm	350 mm	7 kg
HCK	400 - 3500		0 - 3500 V	0 -	200 mA	400 J/s	19" / 443 mm	3 U / 133 mm	350 mm	11 kg
HCK	800 - 3500		0 - 3500 V	0 -	400 mA	800 J/s	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
HCK	1600 - 3500	3)	0 - 3500 V	0 -	800 mA	1600 J/s	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
HCK	2500 - 3500	3)	0 - 3500 V	0 -	1,4 A	2500 J/s	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
HCK	5000 - 3500	3)	0 - 3500 V	0 -	2,8 A	5000 J/s	19" / 600 mm	9 U / 399 mm	650 mm	75 kg
HCK	7500 - 3500	3)	0 - 3500 V	0 -	4,2 A	7500 J/s	19" / 600 mm	12 U / 535 mm	650 mm	110 kg
HCK	10000 - 3500	3)	0 - 3500 V	0 -	5,7 A	10000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	240 kg
HCK	20000 - 3500	3)	0 - 3500 V	0 -	11 A	20000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCK	100 - 6500		0 - 6500 V	0 -	30 mA	100 J/s	19" / 443 mm	3 U / 133 mm	350 mm	6 kg
HCK	200 - 6500		0 - 6500 V	0 -	60 mA	200 J/s	19" / 443 mm	3 U / 133 mm	350 mm	7 kg
HCK	400 - 6500		0 - 6500 V	0 -	120 mA	400 J/s	19" / 443 mm	3 U / 133 mm	350 mm	11 kg
HCK	800 - 6500		0 - 6500 V	0 -	250 mA	800 J/s	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
HCK	1600 - 6500	3)	0 - 6500 V	0 -	500 mA	1600 J/s	19" / 443 mm	6 U / 266 mm	650 mm	35 kg
HCK	2500 - 6500	3)	0 - 6500 V	0 -	750 mA	2500 J/s	19" / 443 mm	6 U / 266 mm	550 mm	40 kg
HCK	5000 - 6500	3)	0 - 6500 V	0 -	1,5 A	5000 J/s	19" / 600 mm	9 U / 399 mm	650 mm	75 kg
HCK	7500 - 6500	3)	0 - 6500 V	0 -	2,3 A	7500 J/s	19" / 600 mm	12 U / 535 mm	650 mm	110 kg
HCK	10000 - 6500	3)	0 - 6500 V	0 -	3 A	10000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	240 kg
HCK	20000 - 6500	3)	0 - 6500 V	0 -	6 A	20000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCK	100 - 12500		0 - 12500 V	0 -	15 mA	100 J/s	19" / 443 mm	3 U / 133 mm	350 mm	6 kg
HCK	200 - 12500		0 - 12500 V	0 -	30 mA	200 J/s	19" / 443 mm	3 U / 133 mm	450 mm	7 kg
HCK	400 - 12500		0 - 12500 V	0 -	60 mA	400 J/s	19" / 443 mm	3 U / 133 mm	450 mm	11 kg
HCK	800 - 12500		0 - 12500 V	0 -	120 mA	800 J/s	19" / 443 mm	3 U / 133 mm	450 mm	21 kg
HCK	1600 - 12500	3)	0 - 12500 V	0 -	250 mA	1600 J/s	19" / 443 mm	6 U / 266 mm	550 mm	35 kg
HCK	2500 - 12500	3)	0 - 12500 V	0 -	400 mA	2500 J/s	19" / 443 mm	6 U / 266 mm	650 mm	40 kg
HCK	5000 - 12500	3)	0 - 12500 V	0 -	800 mA	5000 J/s	19" / 600 mm	9 U / 399 mm	650 mm	75 kg
HCK	7500 - 12500	3)	0 - 12500 V	0 -	1,2 A	7500 J/s	19" / 600 mm	12 U / 535 mm	650 mm	110 kg
HCK	10000 - 12500	3)	0 - 12500 V	0 -	1,5 A	10000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	240 kg
HCK	20000 - 12500	3)	0 - 12500 V	0 -	3 A	20000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg

3) Three phase mains connection

All units are available with polarity reversal switch. For orders without polarity switch please state the required output polarity.

Mating high voltage connectors (from 35kV complete with 3m cable, from 65kV >5000J/s with 10m cable) are included in the scope of delivery. Mating high voltage cables you'll find beginning with page 51. Capacitor chargers with different from the type range voltage or power are available on request. . (From approx.100V and till approx. 200kV)

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V 0913

Capacitor charging power supplies
Series HCK from 2 kV to 65 kV / 100 J/s to 20 kJ/s

HCK 150000M - 12000
12kV / to 35A
customer specific design,
4-fould 19“ cabinet, cubical

HCK 5000 - 12500
12,5kV / 800mA

HCK 6750M - 30000
(side cover removed)
30kV / 450mA
(650mA up to 15kV)

Design examples

Type			Voltage		Current	Charg. pow.	Width	Height	Depth	Weight
HCK	100 - 20000		0 -	20000 V	0 - 10 mA	100 J/s	19" / 443 mm	3 U / 133 mm	350 mm**	11 kg
HCK	200 - 20000		0 -	20000 V	0 - 20 mA	200 J/s	19" / 443 mm	3 U / 133 mm	350 mm**	12 kg
HCK	400 - 20000		0 -	20000 V	0 - 40 mA	400 J/s	19" / 433 mm	3 U / 133 mm	450 mm	14 kg
HCK	800 - 20000		0 -	20000 V	0 - 80 mA	800 J/s	19" / 443 mm	4 U / 177 mm	550 mm	25 kg
HCK	1600 - 20000	3)	0 -	20000 V	0 - 160 mA	1600 J/s	19" / 443 mm	6 U / 266 mm	650 mm	35 kg
HCK	2500 - 20000	3)	0 -	20000 V	0 - 250 mA	2500 J/s	19" / 443 mm	7 U / 310 mm	550 mm	40 kg
HCK	5000 - 20000	3)	0 -	20000 V	0 - 500 mA	5000 J/s	19" / 600 mm	29 U / 1500 mm	600 mm	120 kg
HCK	10000 - 20000	3)	0 -	20000 V	0 - 1 A	10000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	240 kg
HCK	20000 - 20000	3)	0 -	20000 V	0 - 2 A	20000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	360 kg
HCK	100 - 35000		0 -	35000 V	0 - 5 mA	100 J/s	19" / 443 mm	3 U / 133 mm	350 mm**	12 kg
HCK	200 - 35000		0 -	35000 V	0 - 10 mA	200 J/s	19" / 443 mm	3 U / 133 mm	450 mm	12 kg
HCK	400 - 35000		0 -	35000 V	0 - 20 mA	400 J/s	19" / 433 mm	3 U / 133 mm	550 mm	30 kg
HCK	800 - 35000		0 -	35000 V	0 - 40 mA	800 J/s	19" / 443 mm	4 U / 177 mm	550 mm	30 kg
HCK	1600 - 35000	3)	0 -	35000 V	0 - 80 mA	1600 J/s	19" / 443 mm	6 U / 266 mm	650 mm	50 kg
HCK	2500 - 35000	3)	0 -	35000 V	0 - 140 mA	2500 J/s	19" / 443 mm	7 U / 310 mm	550 mm	50 kg
HCK	5000 - 35000	3)	0 -	35000 V	0 - 280 mA	5000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	390 kg
HCK	10000 - 35000	3)	0 -	35000 V	0 - 570 mA	10000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	450 kg
HCK	20000 - 35000	3)	0 -	35000 V	0 - 1,1 A	20000 J/s	2x19" / 1200 mm	38 U / 2000 mm	800 mm	720 kg
HCK	100 - 65000		0 -	65000 V	0 - 3 mA	100 J/s	19" / 443 mm	3 U / 133 mm*	450 mm**	20 kg
HCK	200 - 65000		0 -	65000 V	0 - 6 mA	200 J/s	19" / 443 mm	5 U / 221 mm*	450 mm**	30 kg
HCK	400 - 65000		0 -	65000 V	0 - 12 mA	400 J/s	19" / 433 mm	7 U / 310 mm*	550 mm	55 kg
HCK	800 - 65000		0 -	65000 V	0 - 25 mA	800 J/s	19" / 443 mm	7 U / 310 mm*	550 mm	60 kg
HCK	1600 - 65000	3)	0 -	65000 V	0 - 50 mA	1600 J/s	19" / 443 mm	8 U / 355 mm*	550 mm	80 kg
HCK	2500 - 65000	3)	0 -	65000 V	0 - 75 mA	2500 J/s	19" / 443 mm	10 U / 443 mm*	650 mm	120 kg
HCK	5000 - 65000	3)	0 -	65000 V	0 - 150 mA	5000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	460 kg
HCK	10000 - 65000	3)	0 -	65000 V	0 - 300 mA	10000 J/s	19" / 600 mm	38 U / 2000 mm	800 mm	500 kg
HCK	20000 - 65000	3)	0 -	65000 V	0 - 600 mA	20000 J/s	19" / 600 mm	29 U / 1500 mm	600 mm***	200/470 kg

3) Three phase mains connection

All units are available with polarity reversal switch. For orders without polarity switch please state the required output polarity.

For the final dimensioning of the capacitor charging power supplies, details regarding the load and the operating conditions are necessary.

*) With polarity reversal switch these units will be 2 units higher.
**) With polarity reversal switch these units will be 100mm deep.
***) The dimensions are valid for the power part. The high voltage part is housed in a separate oil filled container. Weight is stated: Power part / High voltage container

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V 0913

Power supplies for superconducting coils
Series NTS to 65 V / to 10000 A

Design examples

NTS 250000M - 50
Front plate

Features:

- High efficiency
- Short circuit proof and with unlimited operation at full current in short-circuit condition
- Sense terminals for the compensation of the voltage drop on the power lines. By presetting the voltage, a linear current ramp can be generated
- Energizing and de-energizing voltage can be preset with a single potentiometer
- Constant voltage operation for linear up and down control
- Linear de-energization, with reverse voltage permitted up to the nominal value of the output voltage (2-quadrant operation)
- Interlock loop to monitor the external load and internal loop as a standard

Function:

Designed specifically for superconducting coil applications. This power supply family is series regulated, via a set of parallel transistors, which are driven from a pre-regulation stage which utilises phase controlled thyristors. In this manner, the power lost across the output transistors is kept to minimum. Thus, the final control element always has a low power dissipation in energizing and static constant current mode.
In de-energizing mode, the transistor stage is working as a current sink and the power is dissipated by means of either air or water cooling.

Cooling:

Up to approx. 1000A (or approx. 5kW de-energizing power), air cooling. For higher currents, or higher powers, water cooling.

Design:

- Up to 200A (or approx. 2.5 kW) in 19'' table-top cases or plug-in units.
- Units with higher current or power are supplied as 19" cabinets on roller blades. The side panels can be removed, the rear door can be locked.
- All cabinets have removable crane-eyes.

Output:

- Output isolation:

  The output is floating. Operating voltage with respect to earth: for air cooled units max. ±300V DC, for water cooled units max. ±100V DC.
- Output terminals:

  Up to 100A, clamps on the rear. For higher currents we use copper bars.

Technical Data:

- Mains connection:

  Up to 1400W nominal power:
  230V ±10% 47Hz to 53Hz

  For 2800W and higher:
  400V ±10% 47Hz to 53Hz, two-phase

  For 700W and higher:
  400V ±10% 47Hz to 53Hz, three-phase
- Ambient temperature:

  0°C to +40°C

All following data are guide values and will be modified according to the specification.
(For explanations please refer to Definitions and Terms)

- Setting range for current:
  from approx. 0,1% to 100%
- Setting range for voltage:
  from -100% to +100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$ to $\pm 1 \times 10^{-6}$
- Residual ripple (Voltage 0-20MHz):
  approx. 1×10^{-3}pp
- Residual ripple (Current 0-20MHz):
  $\pm 1 \times 10^{-4}$pp to $\pm 1 \times 10^{-6}$pp
  depending on inductivity of the load
- Run up time:
  from 1sec. to 100 hours
- Deviation:
  For ±10% mains voltage variation:
  $< \pm 1 \times 10^{-5}$
  For no load / full load:
  $< 2 \times 10^{-4}$
  Over 8 hours under constant conditions:
  $< \pm 1 \times 10^{-4}$ to $\pm 1 \times 10^{-5}$
  Within the temperature range:
  $< \pm 1 \times 10^{-4}$ to $\pm 5 \times 10^{-6}$ /K

Possible Options:

- Analog programming (see page 44)
- Analog programming, floating (see page 44)
- DVM with higher resolution
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Higher stability
- Current control by electronic ramp with digital control; rise and fall times are adjustable manually or via computer interface
- Current limit setting either manually or via computer interface. Resolution up to 1×10^{-5} for external setting
- High speed turn-off input with adjustable threshold
- Quench detector to monitor the magnet
- Fast de-energizing in the event of quench or mains failure: A DC circuit breaker or a semiconductor switch disconnects the power supply from the magnet. De-energization takes place with a power resistor, actuated at quench, or via an external circuit
- Short circuit switch (Current source 100mA for heating a sector of the superconducting circuit)
- Water cooling

More options and special solutions on request.

For this type of power supplies we don't indicate a range of standard types since it is meaningful to adapt the power and equipment of the units for each single application.

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V 0913

Power supplies for superconducting coils
Series NTS to 65 V / to 10000 A

Design examples

NTS 720 - 8 mod.
8V / 90A
customer specific design for
high temperature super
conductor

NTS 20000M - 10
10V / 2000A

NTS 250000M - 50
50V / 5000A

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Linear regulated power supplies unipolar
Series NLN from 6,5 V to 500 V / 35 W to 1400 W

Design examples **NLN 1400 - 20**
20V / 60A

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms from page 54.)

- Setting range:
  from approx. 0,1% to 100%
- Setting resolution:
  ±1 x 10^{-4}
- Residual ripple (0 - 10MHz):
  <5 x 10^{-4}pp + 10mVpp
- Recovery time:
  <50µs for load changes from 10% to 100% or from 100% to 10%
- Setting time at nominal load:
  <1ms for full range
- Deviation:
  For ±10% mains voltage variation:
  <± 2 x 10^{-5}
  For no load / full load:
  <2 x 10^{-4}
  Over 8 hours under constant conditions:
  <±2 x 10^{-4}
  Within the temperature range:
  <±2 x 10^{-4} /K

Features:

- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- Output voltage and output current are fast programmable
- No output capacitor
- All units are short circuit proof and allow unlimited operation with full current in short circuit condition
- Voltage and current regulation with automatic and sharp transition; control mode indicated by LEDs
- 4½ digit DVM for voltage and current (for table-top models)
- Sense terminals for the compensation of voltage drop on the load lines, for units up to 350V nominal voltage. The rated voltage always refers to the output terminals
- Suitable also for inductive and capacitive loads
- Standard starting current limitation from 700W nominal power onwards

Function:

The mains voltage is transformed to the appropriate level and rectified. The rectified voltage charges a bank of capacitors of the intermediate circuit to a constant voltage, which it is given via a set of power transistors to the output. The series transistor defines the final stability of the output voltage and the regulation speed.
Optionally a set of power transistors parallel to the output can act as a current sink to provide active pull down ability. The design of linear regulated power supplies is optimized for fast programming speed.

Design:

- For 35W nominal power - ½19" table-top case,
- other models - 19" table-top case (19" rack adaptors available)
- Cooling: Convection or built-in fan with air outlet on the rear

Output:

- Output isolation:
  The output is floating. Operating voltage with respect to earth: max. ±500V.
  Each of the output terminals may be connected to earth.
- 4mm safety connectors up to 20A on the rear panel. For higher currents clamps installed on the rear.

Technical Data:

- Mains connection:
  Up to 1400W nominal power:
  230V ±10% 47Hz to 63Hz
  For 2800W and higher:
  400V ±10% 47Hz to 63Hz, three-phase
- Ambient temperature:
  0°C to +40°C
- Power loss:
  At nominal load approx. 25%, during short circuit at nominal current approx 125% of the nominal power.

Possible Options:

- Analog programming (The positive output has to be earthed; see also page 44)
- Analog programming, floating (see page 44)
- DVM with higher resolution
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Active pull-down control. Parallel to the output is a set of power transistors operating as a current sink. (see page 48)
- Higher programming speed

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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V 0913

Linear regulated power supplies unipolar
Series NLN from 6,5 V to 500 V / 35 W to 1400 W

Design example

NLN 700 - 250
250V / 2,8A

Customised design
(Non standard voltage/ current
prepared for 19“ build-in)

Type	Voltage	Current	Width	Height	Depth	Weight
NLN 35 - 6,5	0 - 6,5 V	0 - 5 A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 6,5	0 - 6,5 V	0 - 10 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 6,5	0 - 6,5 V	0 - 30 A	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 6,5	0 - 6,5 V	0 - 60 A	19" / 443 mm	4 U / 177 mm	550 mm	38 kg
NLN 1400 - 6,5	0 - 6,5 V	0 - 120 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg
NLN 35 - 12,5	0 - 12,5 V	0 - 2,5 A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 12,5	0 - 12,5 V	0 - 8 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 12,5	0 - 12,5 V	0 - 20 A	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 12,5	0 - 12,5 V	0 - 50 A	19" / 443 mm	4 U / 177 mm	550 mm	38 kg
NLN 1400 - 12,5	0 - 12,5 V	0 - 80 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg
NLN 35 - 20	0 - 20 V	0 - 1,5 A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 20	0 - 20 V	0 - 6 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 20	0 - 20 V	0 - 15 A	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 20	0 - 20 V	0 - 30 A	19" / 443 mm	4 U / 177 mm	550 mm	35 kg
NLN 1400 - 20	0 - 20 V	0 - 60 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg
NLN 35 - 35	0 - 35 V	0 - 1 A	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 35	0 - 35 V	0 - 4 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 35	0 - 35 V	0 - 10 A	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 35	0 - 35 V	0 - 20 A	19" / 443 mm	4 U / 177 mm	550 mm	35 kg
NLN 1400 - 35	0 - 35 V	0 - 40 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg
NLN 35 - 65	0 - 65 V	0 - 500 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 65	0 - 65 V	0 - 2 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 65	0 - 65 V	0 - 5 A	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 65	0 - 65 V	0 - 10 A	19" / 443 mm	4 U / 177 mm	550 mm	35 kg
NLN 1400 - 65	0 - 65 V	0 - 20 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg

On request we deliver power supplies of this type also with higher power.

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V 0913

Linear regulated power supplies unipolar
Series NLN from 6,5 V to 500 V / 35 W to 1400 W

Design example
Customer specific
special versions

NLN 22500M - 15
15V / 1500A for 0,5s

Special design:
Intermediate storage of energy
Adjustable internal resistance

NLN 3000M - 10
10V / 300A
In rel. Duty cycle 10%

Type	Voltage	Current	Width	Height	Depth	Weight
NLN 35 - 125	0 - 125 V	0 - 250 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 125	0 - 125 V	0 - 1 A	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 125	0 - 125 V	0 - 2,5 A	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 125	0 - 125 V	0 - 5 A	19" / 443 mm	4 U / 177 mm	550 mm	30 kg
NLN 1400 - 125	0 - 125 V	0 - 10 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg
NLN 35 - 200	0 - 200 V	0 - 150 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 200	0 - 200 V	0 - 600 mA	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 200	0 - 200 V	0 - 1,5 A	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 200	0 - 200 V	0 - 3 A	19" / 443 mm	4 U / 177 mm	550 mm	30 kg
NLN 1400 - 200	0 - 200 V	0 - 6 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg
NLN 35 - 350	0 - 350 V	0 - 100 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 350	0 - 350 V	0 - 400 mA	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 350	0 - 350 V	0 - 1 A	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 350	0 - 350 V	0 - 2 A	19" / 443 mm	4 U / 177 mm	550 mm	25 kg
NLN 1400 - 350	0 - 350 V	0 - 4 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg
NLN 35 - 500	0 - 500 V	0 - 60 mA	½19" / 222 mm	3 U / 133 mm	350 mm	5 kg
NLN 140 - 500	0 - 500 V	0 - 250 mA	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
NLN 350 - 500	0 - 500 V	0 - 600 mA	19" / 443 mm	4 U / 177 mm	450 mm	19 kg
NLN 700 - 500	0 - 500 V	0 - 1,2 A	19" / 443 mm	4 U / 177 mm	550 mm	25 kg
NLN 1400 - 500	0 - 500 V	0 - 2,5 A	19" / 443 mm	7 U / 310 mm	550 mm	50 kg

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V 0913

Linear regulated power supplies bipolar
Series NLB from ±6,5 V to ±350 V / 35 W to 1400 W

Design example

NLB 350 - 20
± 20V / ± 15A

The following data applies for voltage and current regulation, and refers to the rated value (unless otherwise stated):
(For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from -100% to +100%
- Setting resolution:
  $\pm 2 \times 10^{-4}$
- Residual ripple (0 - 10MHz):
  $<5 \times 10^{-4}$pp + 10mVpp
- Recovery time:
  Voltage regulation
  <50µs for load changes from 10% to 100% or from 100% to 10%
  Current regulation: <1ms
- Setting time at nominal load:
  <1ms for full range
- Deviation:
  For ±10% mains voltage variation:
  $<\pm 2 \times 10^{-5}$
  For no load / full load:
  $<2 \times 10^{-4}$
  Over 8 hours under constant conditions:
  $<\pm 2 \times 10^{-4}$
  Within the temperature range:
  $<\pm 2 \times 10^{-4}$ /K

Features:

- Single output power supply with adjustable bipolar output voltage and current. Instantaneous change of polarity.
- Voltage and current setting with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- When equipped with an interface or with the analog programming, fast programmable including change of polarity
- Short circuit proof and allow unlimited operation with full current in short circuit condition
- One of the potentiometers is used for set point adjustment (selectable for voltage or current). The second potentiometer is for limiting the respective other value.
- 4½ digit DVM for voltage and current (for table-top models)
- Sense terminals for the compensation of voltage drop on the load lines, for units up to 350V nominal voltage.
- 4-quadrant operation is possible for passive loads (when the stored energy is low, optionally also for active loads or higher energy with reverse current)
- Suitable also for inductive and capacitive loads
- Standard starting current limitation from 700W nominal power onwards

Function:

Bipolar linear regulated power supplies supply one output voltage, where the value and polarity is adjustable. The mains voltage is transformed to the appropriate level and rectified. The rectified voltage charges a bank of capacitors of the intermediate circuit to a constant voltage, which it is fed, via a set of serial power transistors, to the output. The output stages of the positive and the negative circuits are switched together in a push-pull manner. The regulation transistors define the final stability of the output voltage and the regulation speed. Bipolar power supplies are able to operate as 4-quadrant power amplifier. (optionally also for active loads).

Design:

- 19" table-top case (19" rack adaptors available)
- Cooling:
  Convection or built-in fan with air outlet on the rear

Output:

- Output isolation:
  The output is floating. Operating voltage with respect to earth: max. ±500V.
- Output terminals:
  4mm safety connectors up to 20A on the rear panel. For higher currents clamps installed on the rear

Technical Data:

- Mains connection:
  Up to 1400W nominal power:
  230V ±10% 47Hz to 63Hz
  For 2800W and higher:
  400V ±10% 47Hz to 63Hz, three-phase
- Ambient temperature:
  0°C to +40°C
- Power loss:
  at nominal load approx. 35%, during short circuit at nominal current approx 140% and at no load approx. 15% of the nominal power.

Possible Options:

- Analog programming (Output “A0” on “0V” potential, see page 44)
- Analog programming, floating (page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Full 4-quadrant operation, even with active loads
- Higher programming speed

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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Linear regulated power supplies bipolar
Series NLB from ±6,5 V to ±350 V / 35 W to 1400 W

Type	Voltage	Current	Width	Height	Depth	Weight
NLB 35 - 6,5	0 - ±6,5 V	0 - ±5 A	19" / 443 mm	4 U / 177 mm	450 mm	9 kg
NLB 140 - 6,5	0 - ±6,5 V	0 - ±10 A	19" / 443 mm	4 U / 177 mm	450 mm	12 kg
NLB 350 - 6,5	0 - ±6,5 V	0 - ±30 A	19" / 443 mm	4 U / 177 mm	550 mm	22 kg
NLB 700 - 6,5	0 - ±6,5 V	0 - ±60 A	19" / 443 mm	8 U / 355 mm	550 mm	35 kg
NLB 1400 - 6,5	0 - ±6,5 V	0 - ±120 A	19" / 443 mm	10 U / 443 mm	550 mm	55 kg
NLB 35 - 12,5	0 - ±12,5 V	0 - ±2,5 A	19" / 443 mm	4 U / 177 mm	450 mm	9 kg
NLB 140 - 12,5	0 - ±12,5 V	0 - ±8 A	19" / 443 mm	4 U / 177 mm	450 mm	12 kg
NLB 350 - 12,5	0 - ±12,5 V	0 - ±20 A	19" / 443 mm	4 U / 177 mm	550 mm	22 kg
NLB 700 - 12,5	0 - ±12,5 V	0 - ±50 A	19" / 443 mm	5 U / 221 mm	550 mm	35 kg
NLB 1400 - 12,5	0 - ±12,5 V	0 - ±80 A	19" / 443 mm	8 U / 355 mm	550 mm	55 kg
NLB 35 - 20	0 - ±20 V	0 - ±1,5 A	19" / 443 mm	4 U / 177 mm	450 mm	9 kg
NLB 140 - 20	0 - ±20 V	0 - ±6 A	19" / 443 mm	4 U / 177 mm	450 mm	12 kg
NLB 350 - 20	0 - ±20 V	0 - ±15 A	19" / 443 mm	4 U / 177 mm	550 mm	22 kg
NLB 700 - 20	0 - ±20 V	0 - ±30 A	19" / 443 mm	5 U / 221 mm	550 mm	35 kg
NLB 1400 - 20	0 - ±20 V	0 - ±60 A	19" / 443 mm	8 U / 355 mm	550 mm	55 kg
NLB 35 - 35	0 - ±35 V	0 - ±1 A	19" / 443 mm	4 U / 177 mm	450 mm	9 kg
NLB 140 - 35	0 - ±35 V	0 - ±4 A	19" / 443 mm	4 U / 177 mm	450 mm	12 kg
NLB 350 - 35	0 - ±35 V	0 - ±10 A	19" / 443 mm	4 U / 177 mm	550 mm	22 kg
NLB 700 - 35	0 - ±35 V	0 - ±20 A	19" / 443 mm	5 U / 221 mm	550 mm	35 kg
NLB 1400 - 35	0 - ±35 V	0 - ±40 A	19" / 443 mm	7 U / 310 mm	550 mm	55 kg
NLB 35 - 65	0 - ±65 V	0 - ±500 mA	19" / 443 mm	4 U / 177 mm	450 mm	9 kg
NLB 140 - 65	0 - ±65 V	0 - ±2 A	19" / 443 mm	4 U / 177 mm	450 mm	12 kg
NLB 350 - 65	0 - ±65 V	0 - ±5 A	19" / 443 mm	4 U / 177 mm	550 mm	22 kg
NLB 700 - 65	0 - ±65 V	0 - ±10 A	19" / 443 mm	5 U / 221 mm	550 mm	35 kg
NLB 1400 - 65	0 - ±65 V	0 - ±20 A	19" / 443 mm	7 U / 310 mm	550 mm	55 kg

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Linear regulated power supplies bipolar
Series NLB from ±6,5 V to ±350 V / 35 W to 1400 W

Type		Voltage		Current		Width		Height		Depth		Weight	
NLB	35 - 125	0 -	±125 V	0 -	±250 mA	19" /	443 mm	4 U / 177	mm	450	mm	9	kg
NLB	140 - 125	0 -	±125 V	0 -	±1 A	19" /	443 mm	4 U / 177	mm	450	mm	12	kg
NLB	350 - 125	0 -	±125 V	0 -	±2,5 A	19" /	443 mm	4 U / 177	mm	550	mm	22	kg
NLB	700 - 125	0 -	±125 V	0 -	±5 A	19" /	443 mm	5 U / 221	mm	550	mm	35	kg
NLB	1400 - 125	0 -	±125 V	0 -	±10 A	19" /	443 mm	7 U / 310	mm	550	mm	55	kg
NLB	35 - 200	0 -	±200 V	0 -	±150 mA	19" /	443 mm	4 U / 177	mm	450	mm	9	kg
NLB	140 - 200	0 -	±200 V	0 -	±600 mA	19" /	443 mm	4 U / 177	mm	450	mm	12	kg
NLB	350 - 200	0 -	±200 V	0 -	±1,5 A	19" /	443 mm	4 U / 177	mm	550	mm	22	kg
NLB	700 - 200	0 -	±200 V	0 -	±3 A	19" /	443 mm	5 U / 221	mm	550	mm	35	kg
NLB	1400 - 200	0 -	±200 V	0 -	±6 A	19" /	443 mm	7 U / 310	mm	550	mm	55	kg
NLB	35 - 350	0 -	±350 V	0 -	±100 mA	19" /	443 mm	4 U / 177	mm	450	mm	9	kg
NLB	140 - 350	0 -	±350 V	0 -	±400 mA	19" /	443 mm	4 U / 177	mm	450	mm	12	kg
NLB	350 - 350	0 -	±350 V	0 -	±1 A	19" /	443 mm	4 U / 177	mm	550	mm	22	kg
NLB	700 - 350	0 -	±350 V	0 -	±2 A	19" /	443 mm	5 U / 221	mm	550	mm	35	kg
NLB	1400 - 350	0 -	±350 V	0 -	±4 A	19" /	443 mm	7 U / 310	mm	550	mm	55	kg

On request we deliver power supplies of this type also with higher power.

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Bipolar high voltage power supplies
Series HCB from ±1250 V to ±20000 V / 1,4 W to 200 W

Design example

HCB 7 - 6500
± 6500V / ± 1mA

Features:

- Light-weight
- In units with 6,5kV and higher the HV-components are moulded in (removable) silicon resin
- Short-circuit and flash over proof.
- Unlimited operation with rated current in a short-circuit condition
- Voltage regulation and current limitation with automatic, sharp transition, control modes indicated by LEDs
- Voltage adjustment with 10-turn potentiometers with precision scale; the adjusting knob can be locked
- 4½ digit DVM for voltage and current (for table-top models)
- Set point adjustment possible with locked output, release of output voltage by means of an "ON" / "OFF" switch
- 4- quadrant operation possible also for active loads and unlimited power sinking
- Suitable for capacitive and resistive loads

Function:

Bipolar HV power supplies consist of 2 switch-mode controlled HV sources which are connected to the output. In principle, the rectified line voltage in each source drives a square wave generator of fixed frequency, whose AC voltage is transformed, rectified and filtered, producing the positive or negative output voltage. For regulation, the square wave voltage is pulse width modulated. The operation is contra-moving, and the output can be adjusted with continuous zero crossing.

Design:

- 19" table-top case (19" rack adaptors available)

Output:

- Output isolation:
  One output terminal each leads the high voltage, the "0V" terminal is connected firmly to earth. If required, the "0V" terminal can be made floating against earth up to ±300V.
- Output terminals:
  All output terminals are located at the rear plate of the unit. High voltage connectors with the appropriate dielectric strength are delivered with the power supply

Technical Data:

- Mains connection:
  Up to 700W nominal power:
  230V ±10% 47Hz to 63Hz
  For 1400W nominal power and more:
  400V±10% 47Hz to 63Hz, three phase
- Ambient temperature:
  0°C to +40°C

The following data applies for voltage regulation, and refers to the rated value (unless otherwise stated). (For explanations please refer to Definitions and Terms on page 54.)

- Setting range:
  from -100% to +100%
- Setting resolution:
  $\pm 1 \times 10^{-4}$
- Residual ripple (0 - 10 MHz):
  $<3 \times 10^{-4}$pp + 50mVpp,
  typ. 2×10^{-4}pp
- Recovery time for voltage control:
  <1ms for load changes from 10% to 90% or from 90% to 10%
- Setting time at nominal load:
  <200ms
- Deviation:
  For ±10% mains voltage variation:
  $<\pm 2 \times 10^{-5}$
  For no load / full load:
  $<2 \times 10^{-4}$
  over 8 hours under constant conditions:
  $<\pm 2 \times 10^{-4}$
  within the temperature range:
  $<\pm 2 \times 10^{-4}$ /K

Possible Options:

- Analog programming (see page 44)
- Analog programming, floating (see page 44)
- Computer interfaces - IEEE 488, RS 232, RS 422, Profibus DP, USB, LAN (more on request) (see page 46)
- Lower ripple (see page 48)
- Higher stability (see page 48)
- Lower stored energy and shorter recovery time (see page 48)

More options and special solutions on request. Some options may involve changes to the description of the unit - especially concerning the mechanical design.

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V 0913

Bipolar high voltage power supplies
Series HCB from ±1250 V to ±20000 V / 1,4 W to 200 W

Type		Voltage		Current		Width	Height	Depth	Weight
HCB	1,4 - 1250	0 - ±1250	V	0 - ±1	mA	19" / 443 mm	3 U / 133 mm	350 mm	6 kg
HCB	14 - 1250	0 - ±1250	V	0 - ±10	mA	19" / 443 mm	3 U / 133 mm	350 mm	7 kg
HCB	2 - 2000	0 - ±2000	V	0 - ±1	mA	19" / 443 mm	3 U / 133 mm	350 mm	6 kg
HCB	20 - 2000	0 - ±2000	V	0 - ±10	mA	19" / 443 mm	3 U / 133 mm	350 mm	9 kg
HCB	3,5 - 3500	0 - ±3500	V	0 - ±1	mA	19" / 443 mm	3 U / 133 mm	350 mm	7 kg
HCB	35 - 3500	0 - ±3500	V	0 - ±10	mA	19" / 443 mm	3 U / 133 mm	450 mm	10 kg
HCB	7 - 6500	0 - ±6500	V	0 - ±1	mA	19" / 443 mm	3 U / 133 mm	350 mm	10 kg
HCB	70 - 6500	0 - ±6500	V	0 - ±10	mA	19" / 443 mm	3 U / 133 mm	550 mm	15 kg
HCB	14 - 12500	0 - ±12500	V	0 - ±1	mA	19" / 443 mm	3 U / 133 mm	350 mm	30 kg
HCB	140 - 12500	0 - ±12500	V	0 - ±10	mA	19" / 443 mm	6 U / 266 mm	550 mm	42 kg
HCB	20 - 20000	0 - ±20000	V	0 - ±1	mA	19" / 443 mm	6 U / 266 mm	550 mm	35 kg
HCB	200 - 20000	0 - ±20000	V	0 - ±10	mA	19" / 443 mm	6 U / 266 mm	550 mm	45 kg

On request, we deliver power supplies of this type with different voltage or power ranges.

Mating high voltage connectors for units are included in the scope of delivery. Mating high voltage cables you'll find beginning with page 51.

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Technical Appendix
Mains Fuses, Connected Wattage

Type Range	Power Class [W]	Voltage Range	Efficiency	Mains Fuse (Automaten)
NTN	4.200	6,5V upto20V	typ. 70-80%	25A
	7.000	6,5V upto 20V		25A
	10.500	6,5V upto20V		32A
	14.000	6,5V upto 20V		32A
	21.000	6,5V upto20V		50A
	28.000	6,5V upto 20V		80A
	35.000	6,5V upto20V		80A
	50.000	6,5V upto 20V		160A
	4.200	35V upto 350V	typ. 90%	25A
	7.000	35V upto 350V		25A
	10.500	35V upto 350V		32A
	14.000	35V upto 350V		32A
	21.000	35V upto 350V		63A
	28.000	35V upto 350V		100A
	35.000	35V upto 350V		80A
	50.000	35V upto 350V		160A
NYN / MYN / HYN	7.000	All	typ. 86-93%	20A
	10.500	All		25A
	14.000	All		50A
	21.000	All		50A
	28.000	All		63A
	35.000	All		80A
	50.000	All		100A
	70.000	All		160A
	100.000	All		200A
NCA / MCA	3.000	All	typ. 85%	10A
	6.000	All		16A
	9.000	All		20A
MCP	2.800	All	typ. 90%	6A
	4.200	All		10A
	5.000	All		16A
	10.000	All		25A
	15.000	All		35A
HCP	2.800	All	typ. 90%	6A
	4.200	All		10A
	5.000	All		16A
	10.000	All		25A
	15.000	All		35A
HCH	10.000	All	typ 85%	32A
	15.000	All		50A
	20.000	All		63A
	30.000	All		100A
	40.000	All		125A
	50.000	All		160A
HCK	1.600	All	typ 85%	10A
	2.500	All		16A
	5.000	All		32A
	10.000	All		63A
	20.000	All		125A

For design of your electricity supply please provide the next higher rated value of the main fuses used inside the unit. For external fuses use such with delayed action. When circuit breakers are used, we recommend “G” or ”K” characteristic.

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Options and modifications: Analog programming

Many FuG- power supplies are available which differ from the standard design or equipment. On this pages we highlight some of the most common options and modifications. Other customer-specific units having different technical data, different mechanical construction, alternative customer defined interfaces or with extended features are available even for single piece orders.

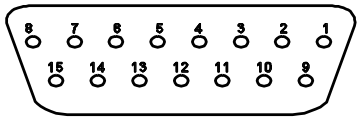
Analog programming:
With this option the output voltage and current of the power supply can be set via analog voltages (0-10V) or by external potentiometers. Monitor signals of voltage and current (0-10V) available on the programming terminal. An external "ON"-command enables the regulation loop.
Selection of manual operation or external programming is possible by a switch on the front panel. This option is also available as a retrofit set for later up gradation of your unit.
Usually the "0V" of the programming voltage is connected to one of the outputs of the unit. If this is not wanted, the unit may be equipped with **floating analog programming.**
For this version:

- Isolation max. 2kV DC with respect to the unit output, 30V DC with respect to ground.

On request we can also supply a fibre optic option with isolation capabilities up to 200kV and more.

For most models, the floating analog programming can be installed later at our site.

Pin Configuration: SUB-D 15 pin



(Solder side of the plug)

Pin	Description	Comment
1	Status report: current regulation	regulation active ≙ approx. +15V via 10kΩ
2	Status report: voltage regulation	regulation active ≙ approx. +15V via 10kΩ
3	Monitor-signal current	0...nominal value ≙ 0...+10V; Ri = 10kΩ (always positive, independent of output polarity)
4	Slider front plate voltage potentiometer	0...+10V depending from position of potentiomer knob (not used with isolated analogue programming)
5	Slider front plate current potentiometer	0...+10V depending from position of potentiomer knob (not used with isolated analogue programming)
6	0V for digital signals	
7	Polarity change for units with electronic polarity reversal (otherwise not used)	open = positive connected to 6) = negative
8	Set value voltage	0...+10V ≙ 0...nominal value
9	0Vfor analogue signals	
10	+ 10 V reference	with reference to pin 9; load up to approx. 2mA
11	Monitor-signal voltage	0...nominal value ≙ 0...+10V; Ri = 10kΩ (always positive, independent of output polarity)
12	Command: „output ON / OFF“	open = OFF connected to pin 6 = ON no mains interruption!
13	Polarity signalization for units with electronic polarity reversal (otherwise not used)	+12V = positive 0V = negative
14	not used	
15	Set value current	0...+10V ≙ 0...nominal value

For single types of equipments, deviations from this configuration are possible (especially for HCN7E, HCB, NLB and custom-designed equipment). In these cases the equipment description is valid.
For proper function of the analog programming at least pin 12 (Output ON/OFF - link to 0V) and both pins 8 and 15 (set values ≠ 0) have to be connected. Using external set value signals, the "0V" line also has to be connected.

On request we also deliver a complete **remote control** with indicating instruments and set-point potentiometers in a separate case (cable length to 10m), matching to the analog programming.

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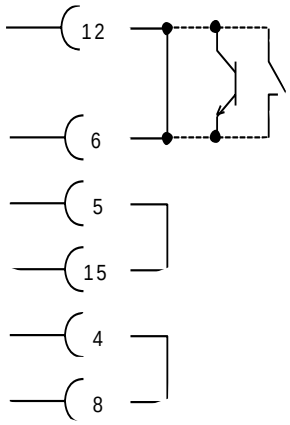
Options and modifications:
Analog programming

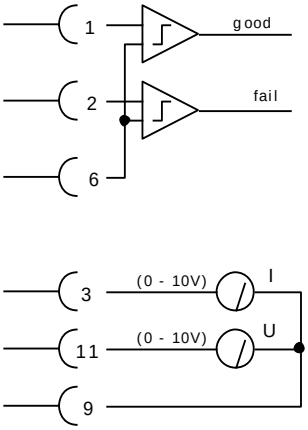
Application notes for the analog programming:

- **Only external ON / OFF, front side potentiometers stay active:**



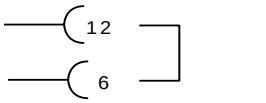
A Link from pin 12 to pin 6 releases the output, a disconnection between these pins locks it. The link can be made by switch, relay contact, wire link, transistor or opto-coupler output (care for correct polarity in the last two cases).
Links between pins 15 and 5 and also between 8 and 4 forward the signals of the front plate potentiometers.

- **Read signals in local mode:**

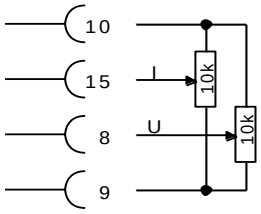


These signals can be read out also when the unit is set to local mode by the mode switch at the front plate (switch in position "local"), so that the values are set by the front plate control elements. By analyzing the status signals (pins 1 and 2) via threshold switches for example a good / fail recognising for isolation tests can be created.
The indication of monitor values by appropriately calibrated measuring instruments with 0 - 10V is also always possible, independently of the mode of control.

- **Output always ON, external input of set values for voltage and current:**

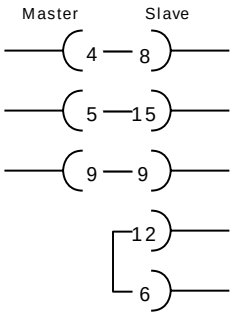


Link between pins 12 and 6 to release the output.



0 - 10V set value input at pins 8 (voltage) and 15 (current). The graphic shows the generation of set values by voltage divider potentiometers, using the internal reference at pin 10. External generation of set values is also possible by digital analog converters or other signal sources.

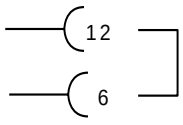
- **Master slave circuit 1:**



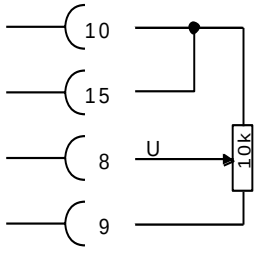
Wipers of the front plate potentiometers (pins 4 and 5) of the master unit are connected to the set value inputs of the slave unit (pins 8 and 15). This allows a symmetrical control of two power supplies.

Link between pins 12 and 6 is necessary to release the output for the slave unit. (For the master unit this depends on the mode of control.)

- **Output always ON, only set value for voltage is with external input, current limited to maximum value.**

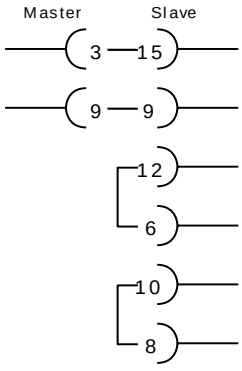


Link between pins 12 and 6 to release the output.



Input of set value only for voltage, pin 15 (set value current) connected to +10V reference, limiting the current to the maximum value by this.

- **Master slave circuit 2:**



The current monitor output (pin 3) of the master is connected to the current set value input (pin 15) of the slave, while the voltage value of the slave is limited to the maximum value (link between pins 10 and 8). This circuit ensures an equal distribution of current with two parallel switched power supplies. The voltage setting is carried out at the master power supply („local" - or „remote"- control possible.)

Link between pins 12 and 6 is necessary to release the output for the slave unit. (For the master unit this depends on the mode of control.)

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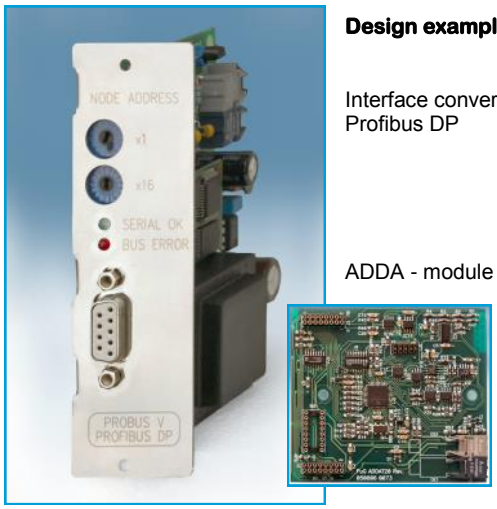
Options and modifications:
Probus V (digital interface system)



Design example

Interface converter
Profibus DP

ADDA - module

General:
The modular interface system **PROBUS V** allows to connect FuG- power supplies with various interfaces and bus-systems.

The **PROBUS V** system consist of two assemblies, the ADDA module and an interface converter respectively.

The **ADDA** module is an intelligent analog-digital and digital-analog converter for controlling the power supply. This part is always in the power supply and communicates by a serial ASCII protocol via optical fibres with the interface converter. It evaluates the programmed commands, controls the power supply by reference voltages and makes available serially the feed back data of the power supply .

The ADDA module stores also all calibration data and all unit specific data.

All commands and read-back-data are transmitted between these both modules as readable ASCII characters.

For customer specific multi-channel-units up to 256 ADDAs can be used parallel by optical fiber hub or can be used serial by a optical fiber chain. Every single ADDA-module of the group can be addressed by sub -addressing. (Not for Profibus DP)

Connection to the customer is made by the **Interface Converter,** which converts the signals of the respective bus system or interface standard to the serial data stream of the optical transfer line.

Available versions:
- IEEE 488
- RS 232 electrical or optical
- RS 422
- USB
- Profibus DP
- LAN (Ethernet)
- More on request

Every version can be integrated completely into the power supply or delivered with an external interface converter. In the last case the connection is via optical fibre cables. The external interface converters are Euro Cassettes of 61mm width (12U), 133mm (3U) high and 170mm deep. The fibre optic cable from the external interface converter to the power supply can be up to 30m long (plastic optical fibre) or in special design more than 1000m (glass fibre).

Furthermore, an external version with electrical connections to the power supply via the analog programming is also possible.

Features:
- Easy programming with SCPI-like syntax; Standard set of commands compatible to previous version PROBUS IV.
- Extended set of commands for special functions.
- Most modern RISC-Microcontroller techniques with SMD.
- Completely digitally adjusted for highest precision.
- Isolation between interface converter and ADDA component via optical fibre, though extremely immune against interferences.
- More than one ADDA components addressable in one optical fibre chain.

Technical data:
- Instruction processing time approx. 300µs (without serial data transfer time)
- At 625kBd at least 1000 settings per second programmable (typ. 2000/sec)
- Up to 100 measurements per second
- Two outputs 0..+/-10V, effective resolution 14 to 20 bit incl. sign (depending on integration time), theoretical resolution 24 bit.
- Setting time of outputs <500us
- Tc < $1x10^{-5}$/K, typ. 3ppm/K
- Two inputs 0..+/-10V, programmable resolution, max. 22 bit incl. sign, input impedance >1GΩ
- Several digital I/Os for control of the power supply
- Optical connectors: Standard Agilent (HP) HFBR-0500 series. Optionally HFBR-0400 series.
- When several ADDA modules are connected to a fibre optic chain, then an additional time delay depending on the selected baud rate and the string length is necessary. For 625kBd approx. 1ms delay per ADDA module must be added.

IEEE 488:
- Delay time of the data transfer: <100us.
- Baud rates on the serial side of the optical link: 38400Bd or 625kBd selectable.
- SRQ (Service Request) programmable.
- LED indicators for "addressed" und "SRQ" conditions.
- Together with ADDA commonly compatible to the IEEE -488 mode of the predecessor PROBUS IV.
- IEEE-488 address selectable by switch near the IEEE-488 connector (outside the unit).

RS 232 electrical (active):
- Own power supply, 3-wire connection sufficient (Rx, Tx, GND).
- Baud rates up to 115200Bd possible.
- Connector: 9-pol. Sub-D.
- Together with ADDA commonly compatible to the RS-232 mode of the predecessor PROBUS IV.
- Optical connectors: Standard Agilent (HP) HFBR-0500 series. Optionally HFBR-0400 series.

RS 232 optical (passive):
- Equal to RS 232 active, but:
- Optical connectors: Direct sticking connection for standard 1mm POF optical link.
- Includes 5m fibre optic cable to connect the power supply to the computer.
- Fibre optic cables up to 30m on request. (Longer version available as special cables, glass fibre up to 1000m)
- The complete interface converter is housed in a Sub-D-connector-like case.

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Options and modifications:
Probus V (digital interface system)

RS 422:

- Baud rates up to 625kBd possible.
- Optical connectors: Standard Agilent (HP) HFBR-0500 series. Optionally HFBR-0400 series.

USB:

- Control via virtual COM-Port or directly via USB-driver. (Virtual Com-Port driver for the most common operation systems available, very simple programming, no USB-programming knowledge necessary.)
- Delay time typical approx.1ms due to USB principle.

LAN (Ethernet):

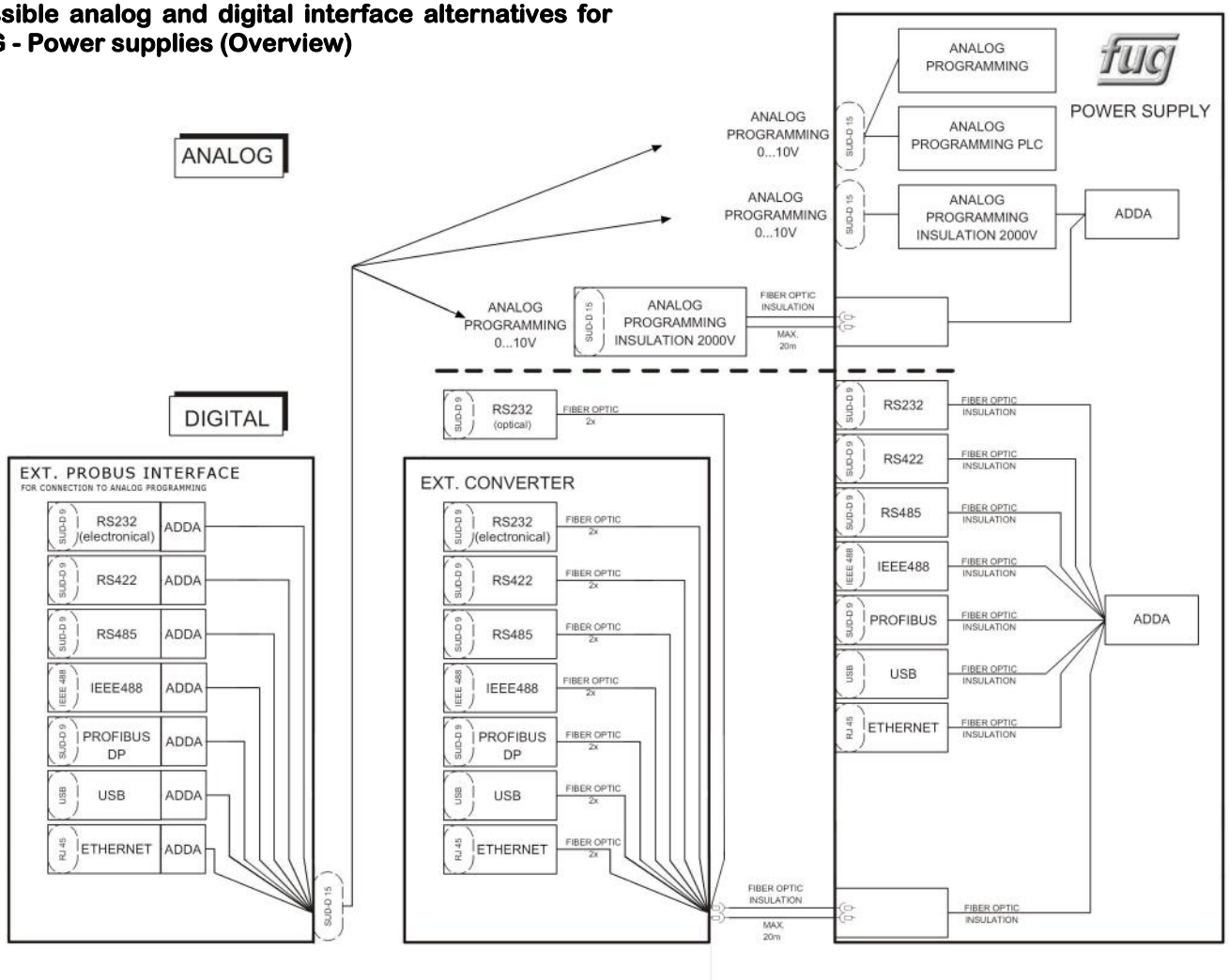
- Control via virtual COM-Port or directly by TCP/IP-programming. (Virtual Com-Port driver for the most common operation systems available, very simple programming, no profound knowledge of TCP/IP-programming necessary.)
- Delay time approx. 20ms.

.

Profibus DP:

- An initial data block is made available on the Profibus-DP side. Into this the primary SPS writes the required set points and control commands.
- This initial data block is transferred cyclically by the converter via optical link to the ADDA part.
- The feedback data (e.g. measurements) of the ADDA part is questioned cyclically and provided n the exit data block of the converter to the primary SPS.
- Cycle time 40ms.
- Profibus address selectable by code-switch outside the unit.
- Mode indication for Profibus connection (red Error-LED).
- Mode indication for optical link.
- The Profibus-DP interface does not support the interconnection of several ADDA modules

Possible analog and digital interface alternatives for FuG - Power supplies (Overview)



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Options and modifications: Further possibilities

Polarity reversal:
By this switch the output voltage polarity of a high voltage power supply (Nearly all of the HCP, HCK or HYN types) can be changed.
With HCP up to 35kV it is possible to remote control the polarity change if the units are equipped additionally with an analog programming or with digital interface. For the most models the polarity reversal can be installed later at our site. On request please ask us!

Higher stability:
Voltage and/or current regulation with better long-term stability and lower temperature coefficient. With a lot of models, using components with a better specification and lower temperature coefficient the following data can be reached:

- Stability over 8 hours under constant conditions: $<\pm 1 \times 10^{-5}$
- Temperature coefficient: $<\pm 1 \times 10^{-5}$ /K within the specified temperature range

On request we can achieve for certain units even a higher stability.
These options can be incorporated only in new units. A later modification is not possible. These options are not available for cassette power supplies.

Lower output ripple:
On several series a lower ripple can be achieved by better smoothing. This option can be supplied only with new units. A later modification is not possible. The following data will be achieved:

- For MCP / HCP up to 35W: $<1 \times 10^{-5}$ + 10mV p-p
- For MCP / HCP 140W to 700W: $<1 \times 10^{-5}$ + 20mV p-p
- For MCP / HCP of 1400W and higher power: $<1 \times 10^{-5}$ + 100mV p-p

This option is not available for cassette power supplies and for power supplies of the NTN series.

Lower stored energy:
Especially for the operation of gas discharge processes, arcs or similar loads with a negative dynamic resistance characteristic, the quantity of stored energy can be decreased by smaller output capacitors. Those units will have than a higher ripple up to 1%. This option is available for units of the series MCP, HCP or HCH.

Digital meters with higher resolution:
For units, which are equipped with 3½ digit DVM in the standard version (Units in cabinet case: display of max."1999"), instead of the standard DVM, a DVM with higher resolution (4½ digit) can be offered. This replacement is also possible later at our site.
For customer specific units even higher display resolutions are possible (Only for new units in combination with a higher stability).
Standard table top units are equipped with 4½ digit meters.

Higher adjustment resolution:
By an additional ten-turn potentiometer for fine adjustment of current and/or voltage the resolution will be increased by a factor of 100. Adjustment range 0 - 99% and a window of approx. 1%.

Power regulation with display and adjustment:
Besides the standard voltage regulation and current regulation, the units may be equipped with an additional regulation loop for constant power.

Internal impedance:
For electronic simulation of a changing internal impedance of the unit (e.g. battery characteristic). The technical design is similar to the power regulation.

Preset indication:
The preset values can be displayed by a button besides the appropriate meter. (For table-top units standard.)

Electronical sweep of nominal value:
Ramp function especially for superconductor power supplies.

Flashover sensor:
Supervising on over-current/ high voltage flashover with signalization, shut down or spark counter.

Interlock loop for supervising of the connected load (e.g. door contacts):
At interrupting the interlock loop, the unit will be shut down by disconnecting the mains. Only after pressing the "RESET"- button, the unit can be put into operation again.

Fast discharge of the output:
When the unit is shut down, e.g. together with the interlock loop, additionally the output capacitor will be discharged within a distinct time. To offer this, we need additional information on the desired discharge time, frequency of such discharges and any existing external capacitance which needs to be discharged.
On request please ask us!

Active down regulation:
For fast controlled decrease of the output voltage.

Different mains voltage and frequency:
As a standard, our units are designed for a 230V, 50Hz or 400V, 50Hz three phase mains input. But most of our units can be modified for other mains values, like they are used in other countries.

Higher isolation of the output and/or the mains input:
For special applications (e.g. the operation at a high voltage platform), the standard isolation of the unit may be not sufficient. We can deliver units with isolations up to > 200kV.

Customer specific design of the power output:
For several types of our units the output, as a standard, is at the front or at the rear plate. Optionally on request it can be moved to any other place.

Temperature regulated fan:
Switch on of the fans of a cooled by forced air unit only at higher power request. This option can be delivered for some models only if there are no strong requests for the stability of the current regulation.

Please take into account that many of the options and modifications mentioned here require a further technical specification. Furthermore, we will gladly offer you more special equipments and modifications on request.

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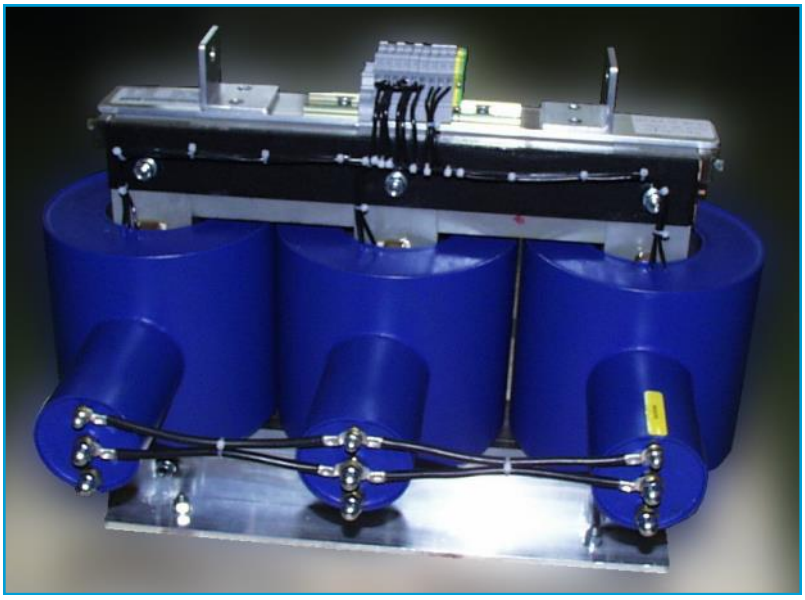
Accessories:
Isolating transformers

Design examples

HTS 200 - 50



HTS 3000 - 50 3p
Three phase version

Function:

High voltage isolating transformers are used to provide mains supply to loads located on a high voltage potential. The primary winding is earthy.

Features:

- Compact size
- Moulded in artificial resin
- Low capacity
- Double screened

Technical data:

- Input voltage:
  230V 47 - 63Hz
- Output voltage:
  230V 47 - 63Hz
- Isolation:
  primary / secondary: 50kV DC
- Test voltage:
  75kV DC for 1 min.
- Test voltage between primary winding, primary screen and core: 7.5kV DC
- Test voltage between secondary winding and secondary screen: 7,5kV DC

Design:

- Mechanical design:
  Core and windings are completely moulded in artificial resin with isolating cross-pieces between the connections. Attachment at the bottom with 4 x M8 female thread.
- Connections:
  Primary and secondary side by threaded bolts, M6, to top, screen connections on free wire endings.

Special designs:

- Different voltages
- Different isolation voltages
- Higher power
- Three phase versions (see picture above)

Type	Nominal power	Width	Hight	Depth	Weight
HTS 100 - 50	100 VA	165 mm	220 mm	160 mm	15 kg
HTS 500 - 50	500 VA	210 mm	230 mm	200 mm	21 kg
HTS 1000 - 50	1000 VA	210 mm	200 mm	200 mm	25 kg
HTS 2000 - 50	2000 VA	252 mm	260 mm	252 mm	40 kg
HTS 3000 - 50	3000 VA	252 mm	270 mm	250 mm	43 kg

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Accessories:
Mechanical components

Rack adapters
We offer rack adapters for the installation of all FuG- tabletop models into 19" systems. They are available for mounting heights from 2U to 9U and both for 19” and for ½ 19" units.

For retrofitting of 19" rack adapters please state the height of the front panel!

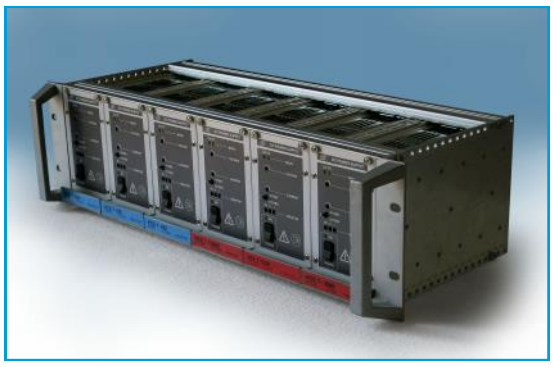
Rack adapter for a 19"- unit

Detail:

Rack adapter for a ½19" unit with ½19" blind panel

Rack adapter for two ½19" units

19“ frames and tabletop cases
For our cassette power supplies of the HCE series, we offer 19“ frames (on the left) or tabletop cases (on the right).



Empty cases and milled front plates according to your specification
We are pleased to offer to you on request.

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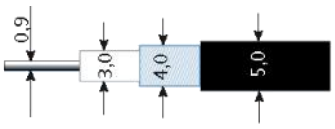
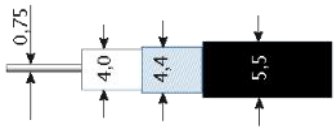
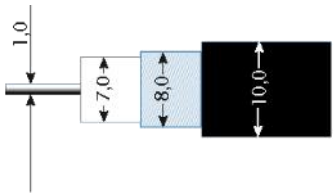
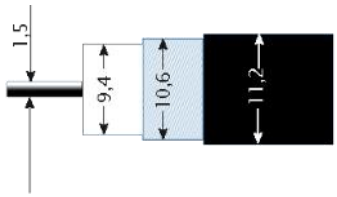
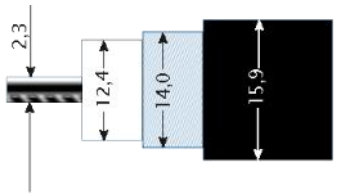
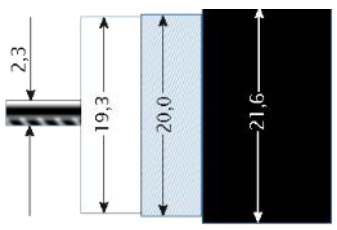
Accessories:
High voltage cables

Type		Design (Diameter in mm)	Max. Cable operating voltage	Mating connector (Operating voltage connector)
RG 58	Mat.- Nr.: 0502030100			
Capacitance/m: Impedance: Ambient temperature: Bending radius: Max. current:	101pF 50Ω -50°C … +80°C 10cm (repeated) 2,5cm (once) max. 10A		**10kV DC**	SHV 6,5kV
130660	Mat.- Nr.: 0502030130			
Capacitance/m: Impedance: Ambient temperature: Bending radius: Max. current:	82,7pF 20Ω -5°C … +85°C 20cm (repeated) 3cm (once) max.4A		**30kV DC**	HS21 F3415 20kV
RG 11	Mat.- Nr.: 0502030200			
Capacitance/m: Impedance: Ambient temperature: Bending radius: Max. current:	68pF 75Ω -50°C … +80°C 20cm (repeated) 5 cm (once) max. 6A		**50kV DC**	F3430 35kV
C 2124	Mat.- Nr.: 0502032124			
Capacitance/m: Impedance: Ambient temperature: Bending radius: Max. current:	99pF 61Ω -50°C … +60°C 15,2cm max. 27A		**100kV DC**	HVS 65 65kV HVS 100 100kV
C 2121	Mat.- Nr.: 0502032121			
Capacitance/m: Impedance: Ambient temperature: Bending radius: Max. current:	95pF 51Ω -50°C … +60°C 21,6cm max. 30A		**150kV DC**	Special plug, available only complete with cable
C2134	Mat.- Nr.: 0502032134			
Capacitance/m: Impedance: Ambient temperature: Bending radius: Max. current:	102pF 64Ω -50°C … +60°C 25,4cm max. 55A		**200kV DC**	Special plug, available only complete with cable

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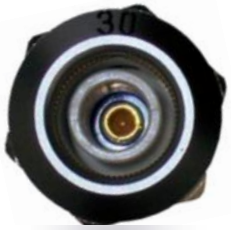
Accessories:
High voltage sockets

SHV– panel connector

RA 3415

HB 21



RA 3430

B 150

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Accessories:
High voltage connectors

SHV- cable jack

F 3415

HS 21

F 3430

S 150, HVS 65, HVS 100, HVS 150 (Difference only in length)

Provided plugs and matching cables for FuG power supplies

For all medium and high voltage power supplies, the appropriate output connectors , as mentioned in the table (excluding banana plugs) are included in the delivery of the unit . Additional connectors (as shown in page 51) can be delivered on request.

For power supply types, not listed in the below table, the output will be designed with special high voltage sockets, chopper bars or clamps. As far as necessary the mating plugs will be also included in the delivery.

	Type		Connector type	Quantity included	Stock number	matching cable	Comment
MCA 750-1500	to	MCA 3000-1500	SHV cable jack	2	0301041105	RG 58	
MCA 750-3000	to	MCA 9000-3000	SHV cable jack	1	0301041105	RG 58	
MCP 14-650	to	MCP 5000-650	SHV cable jack	2	0301041105	RG 58	
MCP 14-1250	to	MCP 10000-1250	SHV cable jack	2	0301041105	RG 58	
MCP 14-2000	to	MCP 15000-2000	SHV cable jack	2	0301041105	RG 58	
MYN 21000-2000			SHV cable jack	2	0301041105	RG 58	
HCP 14-3500	to	HCP 15000-3500	SHV cable jack	1	0301041105	RG 58	
HCP 14-6500	to	HCP 15000-6500	SHV cable jack	1	0301041105	RG 58	
HCP 14-12500	to	HCP 2800-12500	HS21	1	0301040425	130 660	
HCP 14-20000	to	HCP 140-20000	HS21	1	0301040425	130 660	
HCP 350-20000	to	HCP 4200-20000	F 3430 AG 10,2	1	0301040455	RG 11	
HCP 35-35000	to	HCP 4200-35000	F 3430 AG 10,2	1	0301040455	RG 11	
HCP 35-65000	to	HCP 2800-65000	HVS 65	1	0301040570	C 2124	inclusive 3m cable
HCP 140-100000	to	HCP 1400-100000	HVS 100	1	0301040605	C 2124	inclusive 3m cable
HCP 140-150000	to	HCP 700-150000	HVS 150	1	0301040655	C 2121	inclusive 3m cable
HCH 10000-1250			SHV cable jack	1	0301041105	RG 58	
HCH 10000-2000	and	HCH 15000-2000	SHV cable jack	1	0301041105	RG 58	
HCH 10000-3500	to	HCH 30000-3500	SHV cable jack	1	0301041105	RG 58	
HCH 10000-6500	to	HCH 50000-6500	SHV cable jack	1	0301041105	RG 58	
HCH 10000-12500	to	HCH 50000-12500	F 3415 AG 6,2	1	0301040356	130 660	
HCH 10000-20000	to	HCH 50000-20000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCH 10000-35000	to	HCH 50000-35000	F 3430 AG 10,2	1	03 01 04 04 55	RG 11	
HCH 4200-65000	to	HCH 50000-65000	HVS 65	1	0301040570	C 2124	inclusive 10m cable
HCH 2800-100000	to	HCH 50000-100000	HVS 100	1	0301040605	C 2124	inclusive 10m cable
HYN 21000-3500	to	HYN 35000-3500	SHV cable jack	1	0301041105	RG 58	
HYN 70000-3500			Copper busbar				
HYN 21000-6500	to	HYN 70000-6500	SHV cable jack	1	0301041105	RG 58	
HYN 21000-12500	to	HYN 50000-12500	F 3415 AG 6,2	1	0301040356	130 660	
HYN 7000-20000	to	HYN 50000-20000	F 3430 AG 10,2	1	0301040455	RG 11	
HCE 7-1250	to	HCE 350-1250	SHV cable jack	1	0301041105	RG 58	
HCE 7-2000	to	HCE 350-2000	SHV cable jack	1	0301041105	RG 58	
HCE 7-3500	to	HCE 350-3500	SHV cable jack	1	0301041105	RG 58	
HCE 7-6500	to	HCE 350-6500	SHV cable jack	1	0301041105	RG 58	
HCE 7-12500	to	HCE 350-12500	F 3415 AG 6,2	1	0301040356	130 660	
HCE 7-20000	to	HCE 350-20000	F 3415 AG 6,2	1	0301040356	130 660	
HCE 7-35000	to	HCE 350-35000	F 3430 AG 10,2	1	0301040455	RG 11	
HCK 100-2000	to	HCK 10000-2000	SHV cable jack	1	0301041105	RG 58	
HCK 100-3500	to	HCK 10000-3500	SHV cable jack	1	0301041105	RG 58	
HCK 100-6500	to	HCK 10000-6500	F 3415 AG 6,2	1	0301040356	130 660	
HCK 20000-6500			F 3430 AG 10,2	1	0301040455	RG 11	
HCK 100-12500	to	HCK 20000-12500	F 3415 AG 6,2	1	0301040356	130 660	
HCK 100-20000	to	HCK 20000-20000	F 3430 AG 10,2	1	0301040455	RG 11	
HCK 100-35000	to	HCK 20000-35000	S 150 Teflon	1	03 01 04 05 56	C 2032 SNJ	
HCK 100-65000	to	HCK 20000-65000	HVS 65 Teflon	1	0301040569	C 2184	incl. cable
HCB 1,4-1250	to	HCB 70-6500	SHV cable jack	1	0301041105	RG 58	
HCB 14-12500	to	HCB 140-12500	F 3415 AG 6,2	1	0301040356	130 660	
HCB 20-20000	to	HCB 200-20000	F 3430 AG 10,2	1	0301040455	RG 11	

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Definitions and Terms

Absolute accuracy
The stated figure refers to the absolute deviation of the DVM, or of the monitors of the analog programming. They are independent of the stability data of the individual series.

For all families with standard data the following absolute accuracy values apply:

- for all nominal voltages:
  < ± 0,2% of the nominal value
- for all nominal currents within the range > 5mA up to < 200A:
  < ± 0,2% of the nominal value
- without this range:
  < ± 0,5% of the nominal value
- additional error of the DVM:
  < ± 2 Digits

Active pull-down control
Available on demand especially for the NLN series: Power transistors parallel to the output acting as a current sink.

Autoranging power supply
Power supply with automatic ranging of the operating point. without steps. These power supplies can provide any combination of the rated current and voltage - limited only by the rated maximum available output power.

Bipolar power supply
A bipolar power supply can be adjusted from positive output voltage and current to negative with continuous zero crossing. All bipolar power supply units of FuG Elektronik GmbH are designed for restricted 4-quadrant operation. The electrical power stored within the load can be subsequently reabsorbed by the power supply. On request the units can be equipped for full 4-quadrant capability.

CE mark
All FuG- power supplies have a CE label - a guarantee of compliance with the current EMC and safety standards.

Certificate of calibration
All FuG- power supplies can be calibrated at the factory. The certificate of calibration, which can be supplied on request, confirms the compliance of the output data with the catalogue data:

- Indication on the DVM
- Monitor voltages*)
- Computer output data*)
- Reference voltage*)
- Linear coherence between control voltage and output value*)

*) Options

Charging current
FuG- capacitor charging power supplies operate with constant current. It is adjustable to every value up to the nominal value. On request, units are available with enhanced charging current at low voltage.

Charging power
Power specification for capacitor charging power supplies. The data is in J/s, and is valid for charging from "0" to the nominal voltage. For charging of a partially discharged capacitor a considerably higher charging power, up to double, can be supplied.

Chopper controlled
See Switch mode power supply.

Deviation (Stability data)
This term is always referred to the nominal parameter value and is valid for operation under constant operating conditions. Constant operating conditions means that, in each case, all other conditions such as the load, ambient temperature and mains voltage are constant:

a) Deviation of the output voltage (or output current when specified) for ±10% variation of the line voltage.
b) Deviation of the output voltage (or output current when specified) over a period of 8 hours, after an appropriate warm up time.
c) Deviation of the output voltage at load changes from full load to no load.

Discharge time constant
This data always relates to the unconnected output. It is the time taken for the output voltage to decay to approx. 37% of the adjusted voltage after the output has been switched off.

Double stabilized power supply
Such units are equipped with a thyristor pre-regulator followed by a linear transistor regulator stage. The high efficiency of the thyristor pre-regulator stage is combined with the high regulation characteristics of a linear regulator.

Dump switch
Rapid discharge switch for the controlled discharging of internal and external capacitors. (see also Interlock)

Efficiency
The efficiency of the units depends on the respective operating point. At full load a figure of 85 -95% will be reached with switched and thyristor regulated power supplies ,whilst 70 -90% is achievable with linear regulated power supplies with thyristor pre-regulation.

Electronic load
A unit, which has the behaviour of an adjustable load resistor. Usually, it is used for testing power supplies. Depending on the design, it is possible to adjust and regulate the resistance, the load power or the load current. FuG offers customized electronic loads on request.

EMC
Electro Magnetic Compatibility. See Regulations and Standards.

EURO-size
19" cassette system cases, 3U

Fast de-energizing
Option for super conductor supplies for controlled de-energization of super conducting coils/magnets at quench.

Final charging voltage
Preset voltage for capacitor charging power supplies up to which the capacitor shall be charged.

Floating output
The specified output terminals have no DC connection to other parts of the unit or to ground. The maximum potential difference (isolation voltage) is indicated.

IMS-size
Older size of plug-in cases, 4U

Interlock
Loop for switching off the output voltage when disconnected. Mains disconnection of the power stage, but without any forced discharging of the output or load. (see also dump switch)

ISO 9001
Since 1994 FuG has maintained this quality assurance system. All supplied units are tested (using calibrated measuring instruments) and the results are recorded in our test department, so as to ensure that all units shipped are fully in accordance with their specification.

Linear regulation
Control of energy flow by one or more of bipolar or field effect transistors which are switched in series to the load and operated with the linear part of their characteristic.

Mains connection
Stated is the mains voltage, the permissible tolerance (±10%), the line frequency range and the type of mains connection, e.g. single phase, two-phase or three-phase. Connection of N (neutral) and PE (protective earth) are always necessary.

Nominal current
Maximum available current.

Nominal power
Maximum available power from the power supply. No higher power is available - even for a short time. For FuG- power supplies the first number in the type name is the power class or the main component of the power supply. This value is approximately (but may be not exactly) the nominal power.

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Definitions and Terms

Nominal voltage
Maximum adjustable voltage. For FuG- power supplies the second number in the type name is usually the nominal voltage of the power supply.

Operational conditions
As far as not otherwise stated in the manual, for Fug power supplies the following conditions are valid:
Temperature: 0 to +40 °C
Humidity: 0 to 85% not condensing
Height over sea level: max. 2000m

Output isolation
On units where the "0V" terminal is not firmly connected to earth (or may be optionally disconnected from earth), it is always shown up to which maximum voltage the terminal may be allowed to float with respect to earth.
For units with floating output (all low and medium voltage power supplies up to 2kV - except cassettes) this value is valid for either of the output terminals.

PROBUS
FuG name for our system of computer interfaces.

PWM-Regulator
Regulator utilising Pulse Width Modulation. Such regulators are used in switch mode power supplies and in drives.

Quench
The transition of a super conducting coil / magnet from super conducting to normally conducting condition. If no special measures are taken, the energy, stored in the magnetic field, will be converted into thermal energy, within a short time, when quench occurs.

Quench detector
Circuit to detect a quench.

Recovery time
This characteristic is stated independently for voltage and current:
For voltage control, it is the time which the power supply requires to return to the adjusted voltage after a load variation from 10% to 100%, or from 100% to 10%.
For current control, it is the time which the power supply requires to return to the adjusted current after a load variation where the output voltage does not change by more than 10% of the nominal voltage.

Regulation mode
Standard power supplies can be operated in constant voltage mode or constant current mode. Switching over takes place automatically with sharp transition. For FuG power supplies the regulation mode is displayed on the front plate by LEDs.

Regulations and standards
The design and production of our power supplies is in accordance with the latest standards for EMC and safety. Depending on the type of the respective unit, different standards are valid:
EMC:
EN61000-6-1 and EN61000-6-3 (single-phase mains connection)
EN61000-6-2 and EN61000-6-4 (two- and three-phase mains connection)
Safety:
EN 61010

Repetition frequency
This frequency corresponds to the repetitive charge and discharge of a capacitor by a capacitor charging power supply. The reproducibility of the end-of-charge voltage depends on the repetition frequency.

Reproducibility
Repeatability of setting of a desired output value under constant conditions - it is always referred to the nominal value of the supply.

Residual Ripple
If not otherwise stated the residual voltage ripple is the referred-to parameter. It is always referred to the nominal value independent of the set value. The frequency of the ripple is the frequency of the mains rectifier and its harmonics. For chopper controlled units there is also a component of the switching frequency (usually 20kHz/40 kHz). For capacitor charging power supplies the value of the charging current is the referred-to parameter.
For FuG- power supplies the residual ripple usually is stated as “Peak to peak”. (“p-p”) value. It is different to the “RMS” value since this measurement also takes into account the short term voltage peaks on full scale.

RMS
The energetically equivalent DC value (also effective value) to an alternating voltage. It corresponds to the square root of the integral of squares (Root Mean Square). For a purely sinusoidal voltage the rms value corresponds to about 36% ($1/(2x\sqrt{2})$) of the "peak-to-peak" value. At a pulse range consisting of narrow peaks (which is typically the case for the residual ripple of a switched mode power supply) the difference can be considerably larger.

Safety
See Regulations and Standards.

Sense terminals
For low voltage power supplies, sense lines can be connected to these terminals to measure the voltage immediately at the load and by this to compensate for any voltage drop on the load-lines. The nominal output voltage always refers to the actual output terminals and does not take account of any voltage drop on the load-lines. The compensation of the voltage drop on the load-lines is restricted to a maximum of 5% of the nominal voltage (minimum of 1V) and has to be considered when choosing a supply.

Setting resolution
Smallest possible steps for the adjustment of voltage or current - always referred to the nominal value.

Setting time
The time required before the output value of a power supply reaches the set value in the limits of the stated tolerance.

Stability
See deviation.

Standards
See Regulations and Standards.

Switch mode power supply
Power supply where the transmission of energy is performed by high frequently alternating voltage.

Temperature coefficient (Tc)
In addition to the value for long-term stability (see deviation), we also refer to the 'drift' of an output value as a function of the variation in the ambient temperature whilst the supply is operating under otherwise constant conditions. The data is specified as 'per Kelvin' and is only valid within the stated operating temperature range. The Tc is always referred to the nominal value. When the option "higher stability" is integrated, then the Tc figure improves.

Thyristor regulation
Control of energy flow by a phase cutting circuit with thyristors, operating at the frequency of the mains input.

Unipolar power supply
Units with only one polarity and with no regulation through zero.

Warm-up time
Stability data is only valid after a warm-up time of min. 30 minutes.

2-quadrant operation
The unit operates as a current source and also as current sink (electronic load) with only one polarity of the output voltage. (See active pull-down.)

4-quadrant operation
The unit operates as a current source and also as current sink (electronic load) with both polarities of the output voltage. (See also bipolar power supply.)

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Examples for customer specific power supplies:
We design and manufacture according to your requests!

MCP 140 - 2000
Medium voltage precision power supply
Equipped with the options: coarse/fine potentiometers for voltage and current, digital interface, analog programming and power limitation.

HCV 3,1M - 12000
Power supply for VUV-Spectrometer
3 outputs in series:
0 - ±100V; 0 - 1mA
0 - +2000V; 0 - 1mA
0 - +10000V; max. 0,1mA

HCV 57M - 20000
Multiple output high voltage supply
19 voltage sources with 11 output voltages
from 6kV to 20kV

NLV 27M - 400
Power supply for beam deflection
5 double outputs with counter moving voltages:
0 - ±400V; max. 1mA

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Examples for customer specific power supplies:
We design and manufacture according to your requests!

MCP 1100 - 1100
Power supply for undersea applications
0 - 1,1kV, 0 - 1A
With two separate switchable outputs, isolated and monitored, Wide input range 85V - 265V

HCV 349M - 6500
High voltage supply for backward wave tube
0 - 6,5kV, 0 - 50mA
With floating heater supply
Special design for airborne use (vibration hard)

HCN7E - 7000
Customer specific test equipment
0 - 7kV, max. 1mA
With test pistol

HCE 2,4M - 12000
Customer specific high voltage module
0 - 12kV, max. 200µA
For picture tube testing

HCM 7,5 - 30000
Customer specific high voltage module
Bipolar
0 - ± 30kV, 0 - ±0,25mA
For mass spectrometers

NTN 100M - 12,5
Isolated low voltage power supply
0 - 12,5V, 0 - 8A
Designed for floating operation up to 20kV

HCN 35M - 70000
Insultation Tester
0 - 70kV, 0 - 0,5mA
Two high-resolution current measurement circuits.

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Examples for customer specific power supplies:
We design and manufacture according to your requests!

HCN 12900M - 300000
High voltage power supply
300kV, 60mA (Fold back to 35mA at full voltage)
Two additional 12.5kV supplies installed for clearing electrodes
For the operation of an electrostatic septum for particle accelerators

HCK 800M - 13000
Cable Tester
13kV / 120mA
Many special functions

HCK 150M - 100000
Capacitor charging power supply
For lightning-arrestor test bench
100kV / 3mA
Special version: Output via brass ball

HCK 50000M - 50000
14 pieces of Capacitor charging power supplies
50kV, 2A
Very high reproducibility (10ppm) for klystron supply of a free electron laser

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Examples for customer specific power supplies:
We design and manufacture according to your requests!

HCV 4200M - 400000
Double High voltage power supply for X-Ray tube

Two symmetrical outputs: 0 to +200kV und 0 to -200kV.

Additional output for anode heater, floating on negative output potential.

Regulation loops for voltage control, current control and emission current control. (Regulation loop is closed via filament current .)

For the calibration of the power supply two high precision voltage dividers are included (right and left)

HCV 141510M - 40000
Power supply for IOT (Inductive Output Tube)
Anode voltage 40kV with max. 3,4A
Additionally, all auxiliary supplies necessary for the operation of the tube, such as heating, grid bias voltage and focusing, are provided.
The electromagnetic field generated by the IOT is used to accelerate electrons for a synchrotron radiation standard to a accurate defined distinct energy.

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Low- and-High Voltage-Power Supplies

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